Issues of performance and synchronisation in music for piano and fixed media.

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Abstract

This written commentary complements my practice-led research in works for piano and fixed media. I explore the symbiotic relations of notation of electronic sounds and how these assist synchronicity in my performance and artistic practice.
As a methodological tool, this document features a categorisation varying from precise to hybrid and imprecise notation. The range of categories has been necessary in order to evaluate the performance implications, which vary significantly when considering the intended outcomes.

This investigation provides examples of commissioned works, which have been analysed alongside existing repertoire. Outcomes of this research have been demonstrated through my performative analysis of works for piano and electronics. The main aims of this research are to provide a guide for the realisation and understanding of these works, and to promote performance and composition of works for piano and electronics.

Introduction

This research addresses the challenges of performing mixed electroacoustic works. In order to analyse my own performance I will provide an account of how the existent notations of the electronics influences my artistic research. For performers, this document will serve as a reflective guide on the preparation and realisation of electroacoustic works. Composers can draw conclusions from the different approaches to notation and apply similar techniques to their own creative work in order to enhance its performance qualities.

At present, there is no formalised manner of representing electronic sounds, specifically pertaining to an ambiguity in the language used by each different composer. This is mainly due to the nature of electronically realised sonic material. Rhythm and pitch content may be indefinite and the wide variety of available synthesised sounds becomes problematic in relation to traditional methods of notation and their perception.

Early examples of piano works incorporating electronics date from the late 1950s, Karlheinz Stockhausen's *Kontakte* (1958-60) and John Cage's *Music for Piano 85* (1962) being notable examples. Works for piano and electronics have become an increasingly used element in contemporary piano repertoire.[1] The addition of electronics and other media to acoustic performance provides enhanced possibilities for sonic engagement.

My practice-led research focuses primarily on the notation of the tape. However, this commentary will also feature relevant documentation on practical issues that arise from notation such as synchronisation, balance between the electronics and the instrument as well as successful practice and performance strategies.
For the main body of this research it was necessary to narrow the focus down to pieces for piano and pre-recorded electronics, as opposed to live-electronics. The

[1] Electronics will be also referred to as tape, electronics, electronic track or fixed media in this document.

rationale for this is to maintain the common parameter of the performative response that fixed media promotes. In this instance, the performer has a bigger necessity to rely on the written depictions of the aural material as the electronics will need to be followed accurately. Within this common parameter, I have chosen pieces with a variety of notational styles and aesthetics as my intentions are to determine how the notation works in as many different contexts as possible.

This research does not aim to devise a general, all-purpose notation, as each work must be treated differently. In the same manner, this research does not seek to determine an infallible approach to notation, as there are infinite possibilities. Instead, it will provide an assessment of the symbiotic relations between notation and performance which both performers and composers might find useful. I will also explore how the combination of click track and notation of the soundtrack work in performance, and whether having these two elements combined aids or obfuscates the performance.

Consequently, the following questions arose:

1. How do different approaches to notation of electronic sounds affect performance?

2. How might issues of notation and synchronisation affect the collaborative process in the creation of new works for piano and fixed media?

In order to answer the first question, I researched already established repertoire for piano and electronics and analysed the scores of a selection of works.[2] The main aim of the analysis was to find similar approaches in works that might not feature the same style of notation. Simultaneously, it was necessary to assess the response in performance in order to determine whether the combination of notation in both electronics and piano part reflected a certain degree of flexibility or whether it should be considered rigorously. When I first conducted this assessment, it became necessary to classify different approaches to notation. As I intended to assess the provoked response by the style of notation, I created a range of categories:

1) Precise notation;

[2] See appendix 2: Further repertoire chart

2) Hybrid notation (mixture of specific and/or absence of notation);
3) Imprecise notation (and/or absence of notation).

These categories can be considered in relation to the degree of flexibility of synchronisation.[3] The initial finding was that works that feature the most precise representations of the media encourage the most rigorous responses from the performer with regards to coordination. However, synchronisation must be present to some extent due to the nature of fixed media. The aim of the categorisations and the following case-examples is to identify how the problem of synchronisation was approached, as dictated by the style of notation of fixed media.

Additionally, each category will be described and analysed alongside a repertoire example, for indicative purposes.[4] All other works will be presented as case studies. The choice of repertoire includes a wide range of notations in both the electronics and piano part, ranging from traditional to graphic notation. Similarly, it includes examples of realisations of extended techniques and theatricality as these constitute an extra layer of complexity when performing alongside fixed media.

I have commissioned new works for piano and pre-recorded electronics by composers with a variety of aesthetic approaches, potentially to explore a number of notational responses. Most of the composers who took part in providing commissions had no indication of these categories; instead I asked them to apply the approach that they considered most efficient for the tape material. I believe that interfering with the compositional process could have led to unforeseen inputs from the composers and could have influenced their choice of notation. My research aims to assess the notation of the electronics from an observational perspective. I considered that if I collaborated too closely in the compositional and notational process, my findings would have been biased. Consequently, this research would not have been conducted impartially.

[3] There is no reflection on the style or aesthetics through the category system.
[4] Repertoire examples will feature pieces that are part of the repertoire for piano and fixed media. These works were not commissioned for this project.

In conjunction with the analysis of notation, I will include a reflection of my personal practice in each case study in order to answer the research questions. This will provide a record of how the style of notation inspired my approach to practice during the learning and rehearsal process and how this influenced my performance. For this question, it will be necessary in some cases to analyse the style of notation of the piano part.

To complete this research, it has been equally important to consider the available technology in order to assist my performance practice. Where relevant, I will produce an account of how technology has assisted my research. During the fulfilment of this project I have applied the latest techniques and equipment where possible in as many of my performances. In order to document this process, I will describe the software as well as the ideal set up for the performance of each work.

Literature review

This literature review includes a compendium of different views and methodologies by pianists (also instrumentalists), composers and scholars with regards to performance and analysis of works with the addition of electronics. This range in authors' disciplines provides a wholistic account of creating and performing music for instrument and electronics.
The main aim of this review is to provide a frame to my research in performance and to encompass my methodology alongside the existent body of literature. This review will recommend complementary readings, as areas such as analysis of notation and use of technology will not be discussed in my writings in such depth.

I have reviewed doctoral theses of other pianists such as: Kerry Yong (RCM) who provides an exhaustive analysis of his artistic research in performing works for piano and both live and fixed media; Sebastian Berweck (University of Huddersfield), whose doctoral research focuses on the technological aspect of this discipline alongside a compendium of useful analysis of performance; Sarah Nicolls (Brunel University), whose thesis illustrates insightful accounts of the collaborative process between composers and performers alongside her prototypes of a new instrument; Shiau-Uen Ding (University of Cincinnati), who provides useful examples of her practice experience of music for piano and fixed media and additional views of works such as *Tombeau de Messiaen* and *...sofferte onde serene...* .
Xenia Pestova (McGill University) similarly provides an account of her experiences performing music for piano and live electronics, which has been interesting to consider in my research in order to compare different performance implications, she also includes examples of collaborative research with composers as well as a very detailed repertoire chart of works for piano and both live and fixed media. The exercise of reviewing theses has also provided me with insights on different methodologies in order to conduct my artistic research.

Xenia Pestova is also featured in collaboration with composer Andrew Lewis, focusing on the nature of notation on their paper '*The audible and the physical: a gestural typology for 'mixed' electronic music*' which aims to 'develop a unified

approach to serve as a common currency for the discussion, analysis and composition of works involving both live instruments and acousmatic sound.'[5]

The research undertaken by other instrumentalists such as flautist Elizabeth McNutt and cellist Rebecca Turner (doctoral research at Goldsmith University) has shed some light into practice strategies and other common concerns among performers of mixed electroacoustic music. In this chapter, I will highlight recyclable practices approaches that I have considered throughout my investigation.

Scholar Michael Clarke (University of Huddersfield), in his publication *Analysing electroacoustic music: An interactive aural approach* provides examples of different techniques and parameters to keep in mind when analysing electroacoustic music. The focus of this article is to discern how to produce exhaustive analyses with the available technology, using a mixture of aural and software approaches.

Similarly to Clarke, composer Marco Stroppa expresses the need for further research in the fields of notation of mixed electroacoustic music. The featured writings have encouraged my focus on notation as an explanation to some of the performative issues of music for piano and fixed media. For my research I consider the level of detail and style of notation a starting point in order to set a methodology for my practice and research.

One of the most common concerns among musicians unaccustomed to performing alongside fixed media is that the presence of tape provides an unnatural and mechanical reaction in performance. Flautist Elizabeth McNutt expresses this idea thus: "performing with fixed accompaniment is like working with the worst human accompanist imaginable: inconsiderate, inflexible, unresponsive and utterly deaf."[6] Composer Marco Stroppa argues that when performing with electronics: "there is no doubt concerning the crucial importance of time in music, this is a far subtler problem than dealing only with temporal fluctuations [...] If the composition is done in a certain way, nobody in the audience will perceive any temporal

[5] Lewis, Andrew, and Xenia Pestova. "The audible and the physical: a gestural typology for mixed electronic music." In *Proceedings of the Electroacoustic Music Studies Network Conference, Stockholm*. 2012. 1

[6] McNutt, Elizabeth. "Performing electroacoustic music: a wider view of interactivity." *Organised Sound* 8, no. 3 (2003): 299.

awkwardness and the performance will be judged as free as usual."[7] In my research I identify that 'certain way' as a notational study that has been tested through performance and my practice.

The issue of notation has been widely discussed by instrumentalists and composers. McNutt justifies her previous statement as: "[...]notation has not been a key issue. Perhaps this is why many performance scores for electronic music consist of a minimal shorthand, which may omit or obfuscate crucial information. [...] A clear and helpful 'graphic user interface' for the player to read makes performing with electronics both easier and more effective."[8] These thoughts concur with pianist Sarah Nicolls': "Even tape parts [...] often fail to be notated in a clear or useful way[...]. These representations are [...] in practical terms not much use to the performer and simply take up precious space [...], so I therefore often cut them out of scores, replacing them with more descriptive words, or a mixture of normal notational devices and graphic shapes."[9] Nicolls' solution is a common practice among performers of electroacoustic music. The process of understanding and being able to perform to fixed media includes an intensive study of the graphical representations that accompany the piano part. During my investigation, careful analysis of the descriptions has been conducted which included instances of lack of notation.[10] As Nicolls expressed, some representations could be considered detrimental or misleading and could take much needed space for the realisation of the piano material. When the provided notation does not give enough information, it is up to the performer to fill the gaps. In this case, the addition of annotations provides a learning tool for the performer, as it enriches the aural understanding of the tape material. This has been the case in several case studies in the main body of my research.[11]

Notation of the electronics has proven useful, as Michael Clarke explains: "usually the electronic component, whether live or pre-recorded, is not and cannot be fully

[7] Stroppa, Marco. "Live electronics or... live music? Towards a critique of interaction." *Contemporary Music Review* 18, no. 3 (1999): 41-77
[8] McNutt. 298.
[9] Nicolls, Sarah Louise. "Interacting with the Piano." PhD diss., Brunel University School of Arts PhD Theses (2010): 39
[10] See case study 3.1 (Nono).
[11] See case study 2.1 (*Tombeau de Messiaen)* and 3.1 (*...Sofferte onde serene...).*

notated in traditional ways. [...] [I]t helps the performers to follow the tape and coordinate with it, but for the most part it does not give a precise definition of the sounds."[12] In this document, I will demonstrate through my research how the different degrees of accuracy in notation are achieved. Focusing on each case study as a separate approach to notation within the categories.

Andrew Lewis and Xenia Pestova point out that: "the lexicon of gestural archetypes needs to be both expanded and simplified, so that the relationships between related gestural types are clearer. Second, the lexicon should be put to use in analysing complete works for piano and electroacoustics, in order to test its usefulness for the purposes for which it is being created, to refine the taxonomy in the light of that, and to suggest new ways of understanding musical discourse, perhaps by identifying features such as gestural transformation."[13] In my research, I will look at the notation of the electronic track and provide insights on how these notations have influenced my practice as a pianist, however I will not comment in as much detail on the lexicon of notation used by each composer. This is to elicit a deeper insight into how the notation has influenced my practice and therefore be able to focus my research towards performance and practice strategies. Pestova's and Lewis' illustrate different approaches to notation that can be considered by the reader, and similar points to those will be drawn in the case-studies in this document, however not in as much detail.

The methodology that I have envisaged for this project therefore tackles the issue of performance from a notational perspective. However, it is impractical to propose that the only issue from performing with fixed media arises from the quality of the notations. Consequently, my research includes instances of other performance and pianistic challenges, albeit with less emphasis. The challenges that are described derive from my practice approach, which has been focused on the issues of notation. I have refrained from commenting on other areas of performance challenges unless these are a consequence of the addition of fixed media to piano performance. My

[12] Clarke, Michael. "Analysing electroacoustic music: An interactive aural approach." *Music Analysis* 31, no. 3 (2012): 348.
[13] Lewis and Pestova. 12

research is intended as an addition to the literature of electroacoustic performance and my methodology can be regarded alongside the pianists featured in this literature review.[14]

Pianist Shiau-Uen Ding uses different rhythmic approaches as the methodology for her DMA research: "I categorize the rhythmic interaction between piano and tape into four types,[...]: 1) independent with sectional synchronization, e.g. *...sofferte onde serene...*, 2) free with relative synchronization, e.g. *Tombeau de Messiaen* [...] 3) free timing within strict synchronization [...] 4) steady strict rhythm, e.g. *Tombeau de Messiaen."*[15] The case of *Tombeau de Messiaen* is featured in two different categories according to her methodology, as the performance response shifts from strict to free.[16] In this document this issue will be approached within the category of hybrid notation, due to its performative response.

Similarly to Ding, McNutt's methodology and terminology are related to "*fixed regions and fluidity of coordination."*[17] My research refines the different levels of coordination from a notational perspective. As mentioned in the introduction, synchronisation can be considered essential to the nature of electroacoustic performance. I explore the topic of how the desired degree of coordination is achieved in accordance with the provided notation on the score. For this, my methodology serves as a guideline of the performance reaction caused by its notation.

My methodology can be considered closer to Kerry Yong's research, where he compartmentalises works for piano and electronics following these parameters: "A. Notation represents the compositional trope for both the electroacoustics and the piano; B. Cue-sheet model, where the electroacoustic part is a descriptive aural

[14] Shiau-Uen Ding, Elizabeth McNutt, Sarah Nicolls, Rebecca Turner, Xenia Pestova and Sebastian Berweck.
[15] Ding, Shiau-Uen. "Developing a rhythmic performance practice in music for piano and tape." *Organised sound* 11, no. 3 (2006): 6
[16] Ding.
[17] McNutt. 299

score and the piano part gives directions for performance; C. Absence of electroacoustic representation with piano part only."[18]

Indeed, Yong points out that not all works fall completely into one category but a mixture of all of them. The categorization is therefore concluded by its predominant approach and its performative response.

When referring to performance of instrument and tape, Cellist Rebecca Turner points out that the addition of tape can be considered as: "a dictatorial and perfect metronome."[19] Indeed, this is a common feature of electroacoustic works where unison or other tight synchronisation is required. For this, the notation of the tape should be clear and translated to the same style of notation as the piano part. A similar result can be achieved through the use of click-track. Use of click-track should be carefully considered by composers,[20] as Ding explains: "Although helpful, using [...] click-track [...] is antagonistic to deep listening, feeling, and breathing with the tape part as well as openness to the ambient environment."[21] Given the nature of electroacoustic performance, click-tracks, metronome practice and stopwatches are practical tools that should be considered for preparation and practice. When it comes to performing with these elements, the composer and performer need to understand that interferences can occur. Examples of interferences are less aural interaction in the case of click-track and less focus on instrumental detail if using a stopwatch.

Xenia Pestova's thesis focuses on models of interaction with live electronics, featuring examples of transferable responses to my research on fixed media. The last case study in my research presents Piyawat Louilarpprasert's *Rumbling* (2018) for piano and live electronics in order to contextualise further ramifications of my

[18] Yong, Kerry. "Performance practices in music for piano with electroacoustics." PhD diss., Royal College of Music, (2007): 50
[19] Turner, Rebecca. "New Approaches to Performance and the Practical Application of Techniques from Non-Western and Electro-acoustic Musics in Compositions for Solo Cello since 1950: A Personal Approach and Two Case Studies." PhD diss., Goldsmiths, University of London, (2014): 50.
[20] In this document the issue of performing with click-track will be described in the case study of *Google Gets A Dog* (1.2), *Key Jack* (1.4) and *Hitchcock Etudes* (2.3).
[21] Ding. 20

research which contrasts with my research on fixed media.[22] In the case of this work, the degree of interaction was similar to Pestova's description of *Duel* (2007) by Rob Godman: "the pianist can perform with a duo partner who controls the interaction and synchronizes with the computer."[23] My focus in this case study is to appraise how the notation of the live-electronics influences my performance alongside the composer.

With regards to practice strategies, Ding states: "when performing music for piano and tape, the pianist should be listening to the musical interaction between the piano and tape parts rather than relying on the visual score."[24] Aural knowledge of the tape material should always be considered. The aural approach assists performance issues such as dynamic balance and blending which affects the tone production of the piano, although there must be greater depth in the understanding of the tape material in order to enhance performance. The visual representations work as an aid and extra layer of information for the practical realisation.[25]

Turner articulates that some of the challenges are related to aural interactions: "dynamic balancing between the parts: if the tape part is too loud the cello will not be heard above the recording; however, if it is too quiet, the cellist cannot hear the accompaniment and it becomes virtually impossible to play in time."[26] In the main body of this document, I illustrate in each case study how I have achieved optimal set up for performance. In the case of performing with stopwatch, the issue of balance becomes secondary, as there are other means of synchronisation.

Pestova describes effective practice strategies such as: "Splitting pre-recorded material into smaller sections is one possible way to introduce an element of interaction [...] simplifying coordination."[27] In my personal practice it has not been necessary to split the tape into smaller fragments; instead, I have annotated relevant time cues when not provided in the score. In this way, it is possible to select and start

[22] Case study 3.3 Piyawat Louilarpprasert's *Rumbling.*
[23] Pestova, Xenia. "Models of interaction in works for piano and live electronics." PhD diss., McGill University, 2008. 24
[24] Ding. 49
[25] In this case: notation of fixed media.
[26] Turner. 50
[27] Pestova. 13

playing the tape from any desired time interval. This practice strategy has proven successful in cases of dynamic and rhythmic coordination which are features of precise and hybrid notation. On the other hand, splitting tape material has not been considered for performance as the performative response varies if the performer needs to trigger samples on stage.

Performing with fixed media provides an extra element of risk to any performance, not just from the performers' perspective, but also by trusting one's performance on electronic equipment, which needs careful set up and has the potential to fail. Sebastian Berweck's doctoral research demonstrates that adding technology to acoustic performances adds a layer of complexity: "The immense additional efforts that go into the preparation of an electroacoustic concert – efforts that might not even lead to a successful performance – create confusion for the performer interested in producing such music as to how to approach this music."[28] The information and reflections provided in Berweck's thesis are familiar among many performers of this discipline (including myself). His thesis provides a comprehensive review of relevant equipment required for successful performances from a pianist's perspective. It also serves as a very strong contextual document for this discipline and its implications in performance. As the main focus of my research has been placed on the notational perspective, I will not provide exhaustive documentation on my personal experiences of setting up and preparing in the hours prior to concerts. Instead, it would be useful for the reader to consider Berweck's research for this aspect of electroacoustic performance.

As demonstrated by this literature review, the majority of the research featured addresses that the notation of the electronic track will have an effect in performance. Berweck's research provides additional content on the issue of performing with electronics such as realisation of works for live-electronics and set-up strategies, which should be useful in preparation for performances of electroacoustic music.

[28] Berweck, Sebastian. "It worked yesterday: On (re-) performing electroacoustic music." PhD diss., University of Huddersfield, 2012. 11

In the main body of this document I will address how my studies into notation, with regards to its practice, provide insight into the unresolved notational paradigm of performing with electronics.

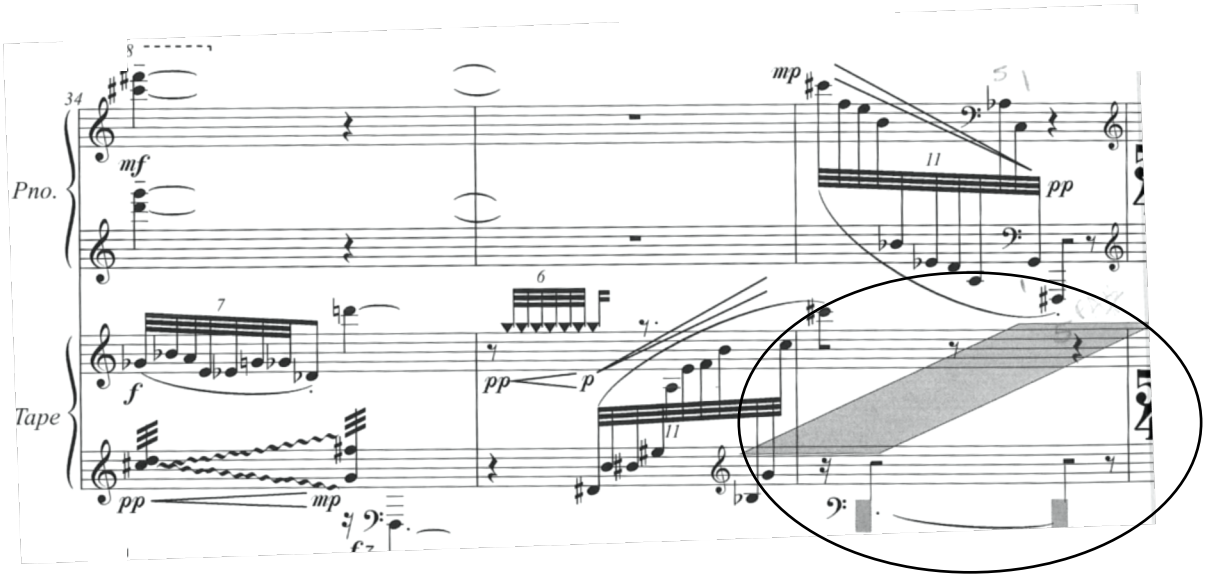
1. Precise Notation

Precise notation presents accurate descriptions of the fixed media material. These representations can be followed and understood in real time when performing on the instrument. The notations might or might not be in accordance with the style of notation presented in the instrumental part, however they present enough information for a preliminary survey of the work.

1.1 Repertoire example: David Horne - *Resound* (1995)

Resound was premiered by the composer in 1995 at Paine Hall in Harvard University. This case study presents a strong argument for precise notation which is reflected by the performance practice of the composer.

The notation of the electronic track is thoroughly described using conventional notation in most cases. Some other sounds are depicted with graphic notation as grey shadows that represent resonances and waves of sounds:



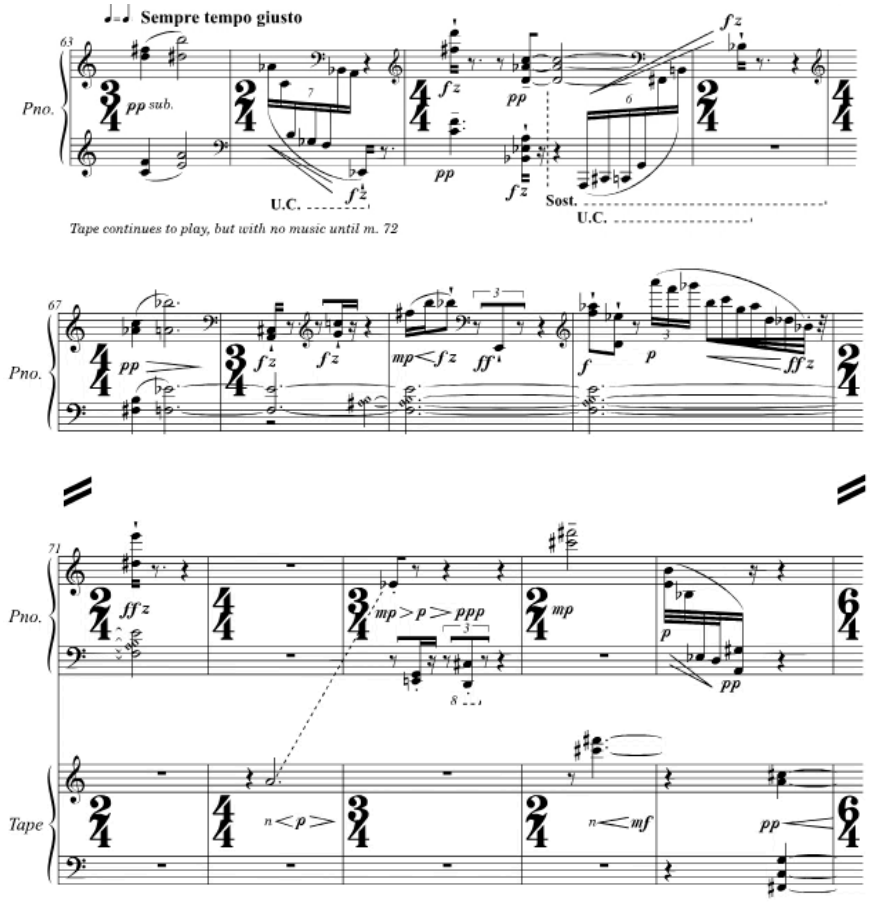
Example 1.1.1: Representation of resonance (b.34-36).

This approach to notation is ideal for such virtuosic material, as it translates the sounds from the electronic track to the same language as the music that is being played. It facilitates coordination and imposes a clear framework for the realisation of the rapid rhythmical gestures. This is caused by the common element in the notation of electronics and piano part.

The similar approach in both notations suggests a performative response akin to a chamber music situation. However, in this case, there is only one active member in the ensemble. Having this resemblance in notations makes the overall result very close ended and contributes to a rigorous response.

The notation and material used in the piano part are intrinsic to the nature of the instrument making most of the virtuosic material very pianistic and logical to the performer. Rapid gestures are conceived to fit within the pianist's hand. Once this is acknowledged it becomes manageable to perform in time.

The tape material allows the realisation of the piano part emulating a metronome. The rapid gestures alongside its precise notation reinforce the sense of pulse for the pianist. For this reason, the most challenging moments in terms of synchronisation are presented when the electronic track is not supporting the performer. The largest solo piano section is from b.63 to b.72.[29] However, there are small passages where the electronic track is silent for a few seconds such as b. 108 and b. 140.

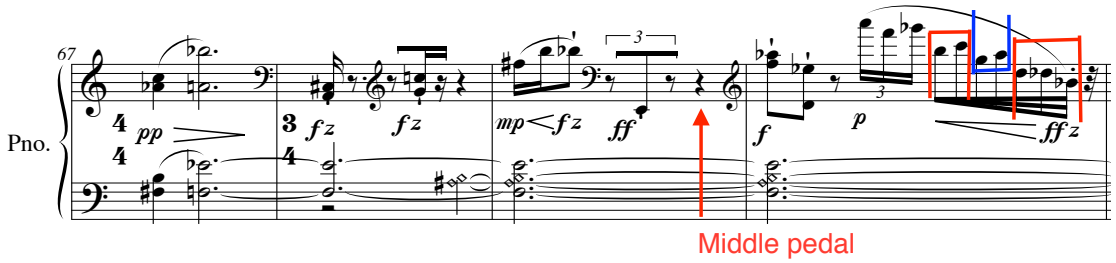


Example 1.1.2: b.63-72.

The pitch coming from *niente* (b.72) and its surrounding rests provide a certain degree of elasticity which assists synchronicity. In this case, it is desirable to be

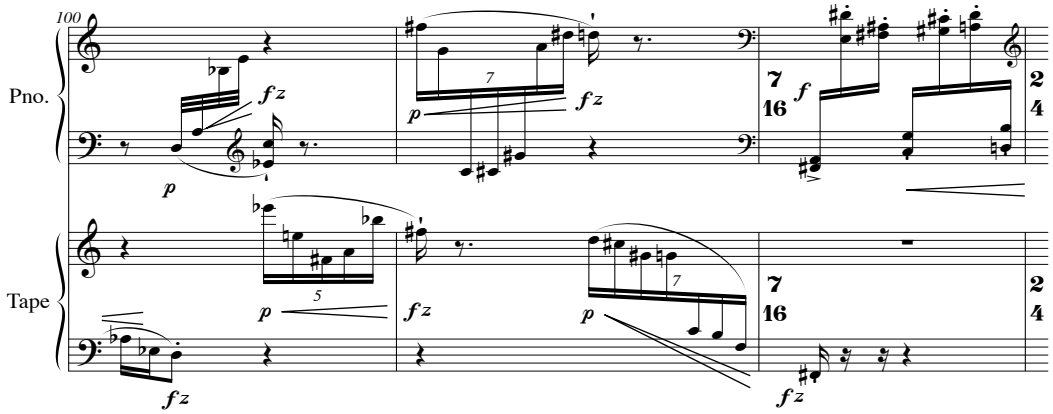
[29] excluding the solo piano introduction from b.1-12.

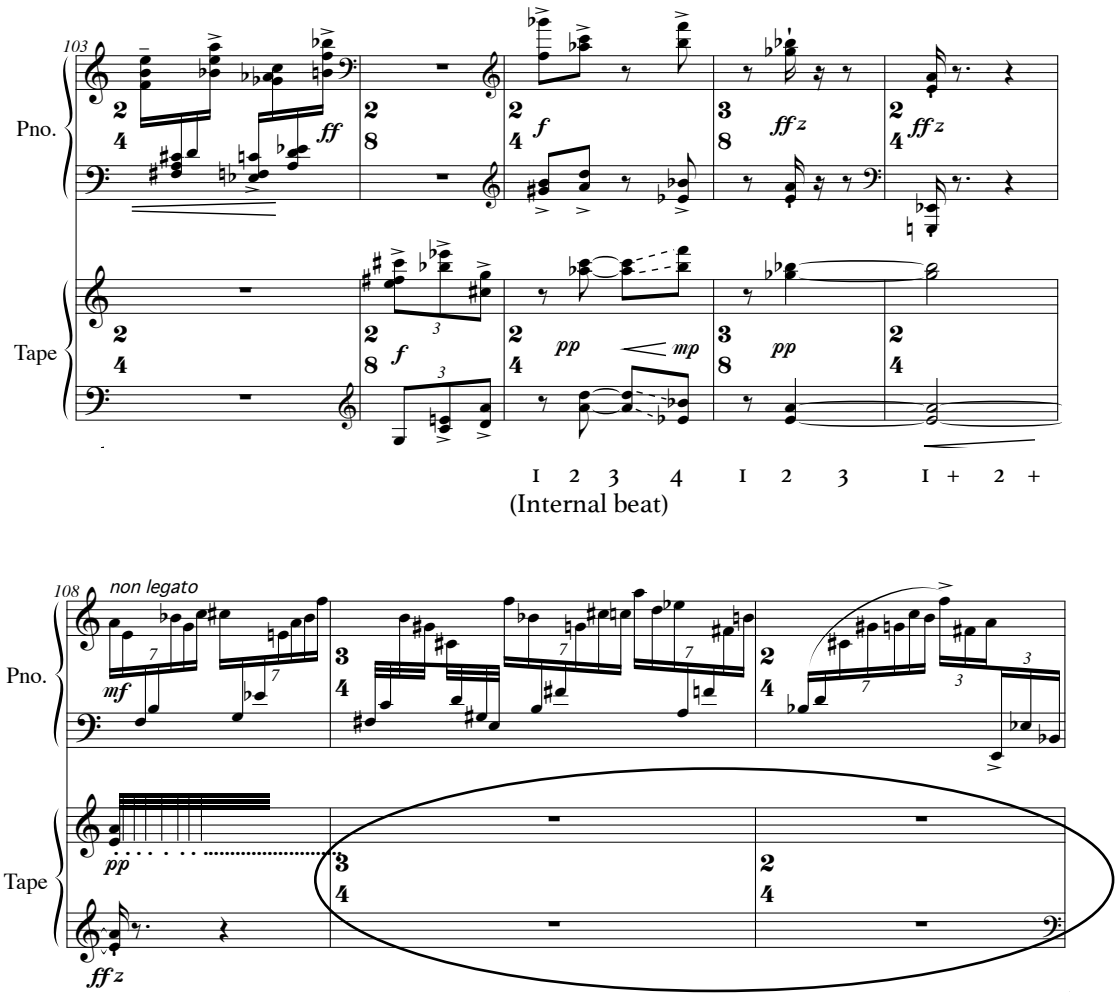
ahead of the tape in the case of misalignment, as there will not be enough time to coordinate successfully after b.72. The gesture in the third beat of b.70 presents rhythmic elasticity. This flexible approach challenges synchronisation as the electronic track is silent at this point. As mentioned before, it is preferable to rush this figure in order to remain synchronous. In my experience, I devised this hand arrangement solution which allowed me to keep synchronous:



Example 1.1.3: Hand arrangement solution (b.70).

Another example where the performer is left without support from the tape can be found in b.109-111. In this case, it is important to disregard the aural cue provided in b.108 and instead establish a strong internal beat. This particular instance can be challenging because of the meter changes in b.102-107 as the gestures in these bars must be performed rigidly, following a strong beat. The tape notation in b.104 is useful for reassurance and can be considered a pick-up point. It is important to pick up the pulse from the quavers in this bar and continue feeling a quaver pulse until the end of b.107. In my experience this bar worked as a transition point between internal pulses. Consequently, the crotchet beat will be reached again at b.108 in order to assist the rhythmical realisation of the rapid passage-work in the following bars.





Example 1.1.4: b.108-110.

With regards to tempo changes, this work features 5 oscillations between 60 and 120 beats per minute as shown in the table below. As the tape is closed-ended in its nature, these tempo changes must be performed as precisely as possible. The fifth tempo change has not been marked on the score and relates to a final tempo of ♩=120.[30] These variations in tempo are relatively easy to achieve in performance because of their proportional relationship. However, the slower passages feature a more indefinite approach to pulse in the tape material, which is more spectral and less rhythmical.[31] For this reason, tempo changes should be carefully considered with regards to beat correspondence, especially when switching to a slower section.

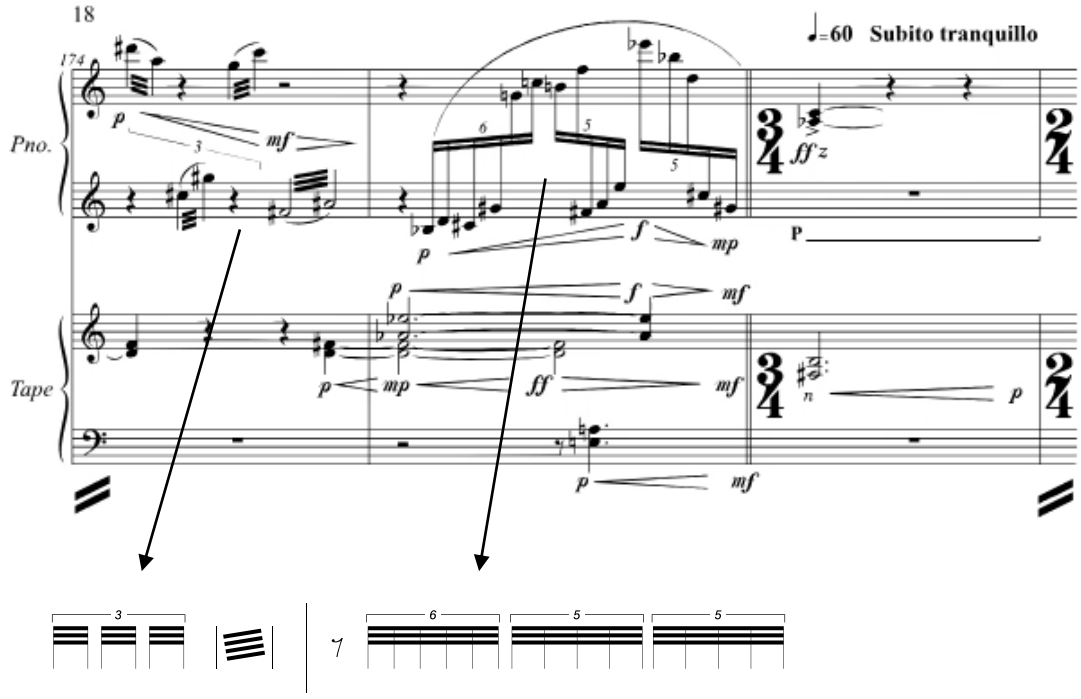
[30] Following the double line in b. 216.
[31] See ex. 1.1.2.

Bar no.	1-37	37-76	76-88	88-175	175-216	216-225
Metronome mark	♩= 60	♩= 120	♩= 60	♩= 120	♩= 60	♩= 120
Total bars	37	39	12	87	41	9

Table 1.1.1: Tempo changes.

The most challenging tempo change for accuracy is on b.175, because it comes after having played fast passage work for the previous 87 bars. In addition, the electronic sounds coming from *niente* can't be used for synchronisation as these do not present a beat. In this case, it has been important to tackle this issue from its leading bars. In order to remain synchronous at these moments, there are several strategies that I considered:

1. <u>Visual</u>: regrouping the rhythm in a double speed fashion from b.167 so I can start internalising the new pulse. This kind of writing is already suggested in the piano part as it resembles the figuration that can be found in 2/2. It has been important to mark this double speed rhythm in b. 175. From the change of tempo onwards, it is important to note the difference in crescendos from *niente* to normal crescendos.



Example 1.1.5: Suggested visual regrouping (b.174-175)

2. Kinaesthetic: it is important at this point to have an accurate muscular response.

3. Aural: The section from b.176 onwards should be considered when sound checking. It is very important to hear the sounds emanating from *niente* as accurately as possible and as early as possible. For instances like this, it is advisable to use a monitor speaker in performance.

With regards to the set up for performance, there is no specific suggestion. In addition to two loud speakers positioned on both sides of the piano, it is advisable to add a small monitor speaker. This addition provides more aural detail and confidence for the pianist, as it reassures optimal interaction and synchronisation. The score does not make reference to piano amplification. Due to the highly detailed piano part and wide range of dynamics, it is preferable not to amplify the piano. This way, the pianist is in control of dynamics and able to present a more natural performance of the work. As mentioned before, b.176 onwards is a good section to sound check as well as b.77-100. Sound check must be thoroughly considered, if possible, in the entirety of the work. This will allow a sense of dynamic freedom in every performance. Depending on concert venues, it might be advisable to have a technician to help with overall balance when performing this work.

Optimal synchronisation relies on an accurate aural image of the contents of the tape. This approach to notation invites a highly rigorous response from the pianist. In this case, it has been achieved with a total synchrony in the use of traditional notation for both the tape and the piano part. The nature of the tape material, especially in its rapid passages, provides a strong sense of pulse and works as a guide for the pianist. Due to this, synchronicity is more accessible when both pianist and tape are playing at the same time. It can be argued that rhythmic information could suffice in this instance. However, including the pitch element among other details such as articulation and dynamics works favourably for the focus of the performer. Consequently, *Resound* represents a clear example of the performative response of precise notation and how it can be achieved through its notation.

1.2 Case study 1: John Uren - *Google Gets A Dog* (2017)

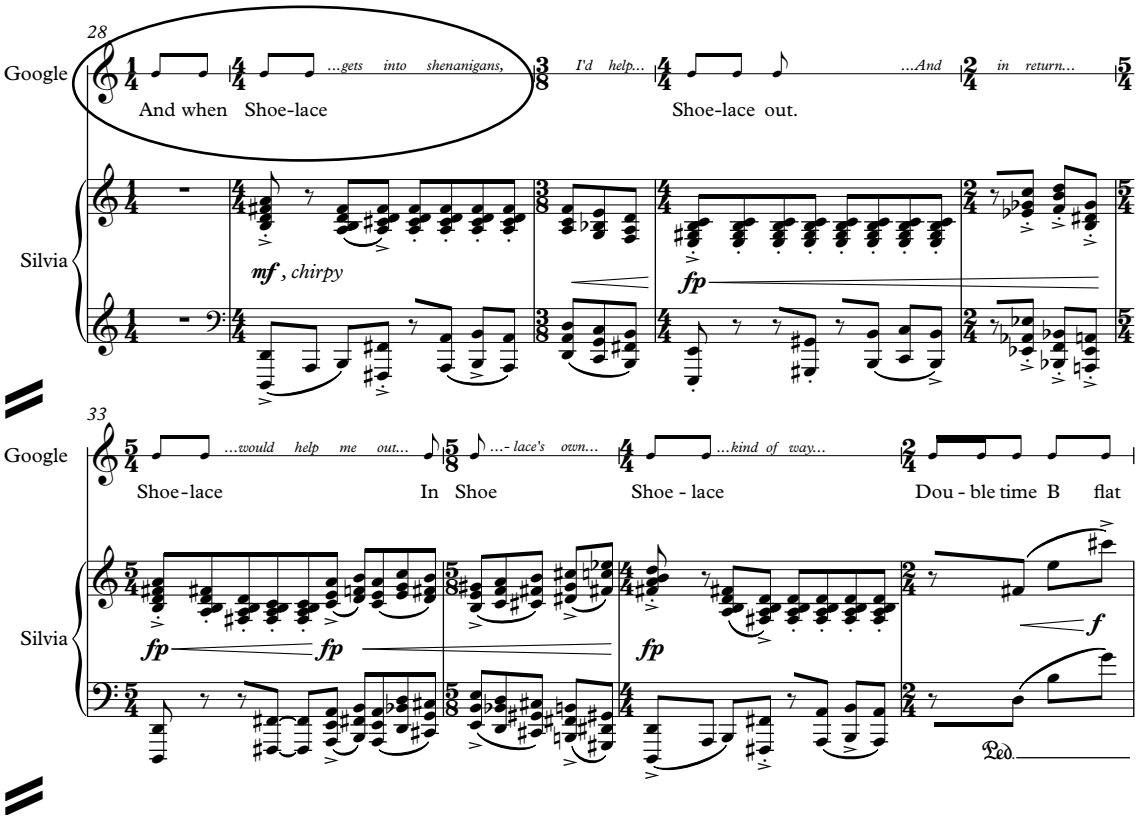
Google Gets A Dog (2017) was the first commissioned work for my research project. At the time of commissioning, Uren had instructions to use electronics and to notate these accurately. Apart from these, I had no other involvement in the creation process of this piece.

I premiered this work as part of the North West New Music festival.[32] Subsequently, I performed it again as part of a lecture-recital in September 2018.[33]

The score is highly precise in its description of electronic sounds which consist of verbal instructions given by the voice command of Google. Therefore, there is no need for pitch representation as the inflections are embedded naturally in text. Precision is obtained by words being notated rhythmically and by achieving a real-time spacing of the words which is sufficient information for an accurate performative response.

The italicised style of notation of the transcript might suggest a flexible approach, as these are not accompanied by synchronising lines. However, Uren's choice of using rhythmised words in strategic points keeps the overall synchronisation. This keeps a clearer score for performance which reflects the apparent simplicity in which this piece should be performed.

[32] 15th of November 2017. Carole Nash Recital Room. Royal Northern College of Music. https://www.rncm.ac.uk/uploads/New_Music_North_West_2017.pdf
[33] Lecture-recital given as part of HARPS. Doctors In Performance conference held at the Lithuanian Academy of Music and Theatre on the 5th of September. 2018.



Ex.1.2.1: Intercalated use of rhythm and text.

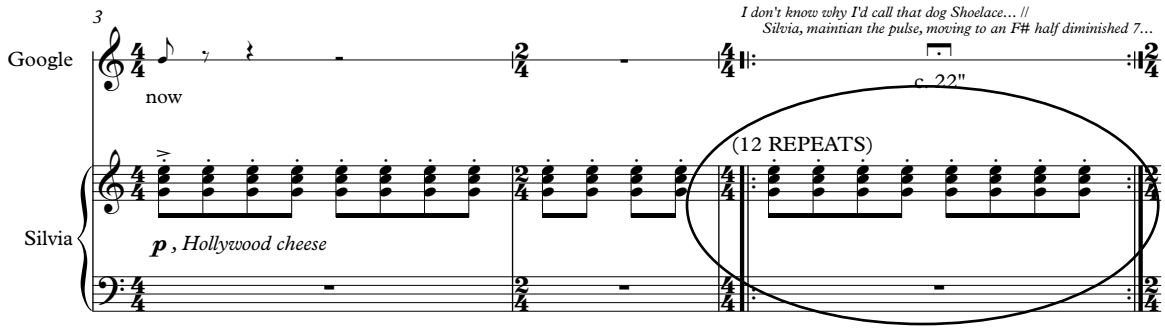
At the same time, it is useful to have the rhythms notated at the end of most Google interludes.[34] They reinforce the sense of pulse at the indicated tempo markings, just before the start of a new piano section.

In order to facilitate the learning process Uren produced a click-track. However, in his performance instructions he pointed out that it should be performed without it and that: "To the audience, the music must suggest that Google is dictating what you are playing in real-time, so for a realistic and accurate synchronisation between the electronic and acoustic elements, ensure that in practise and performance the tempi are followed as precisely as possible."[35] This instruction is suggestive of theatricality; however there aren't any other specific instructions notated in the piece. The case of theatricality will be addressed at the end of this chapter.

[34] This can be seen in b.2, b.28, b.48, b.64, b.83.
[35] J. Uren. *Google Gets A Dog*. 2017.

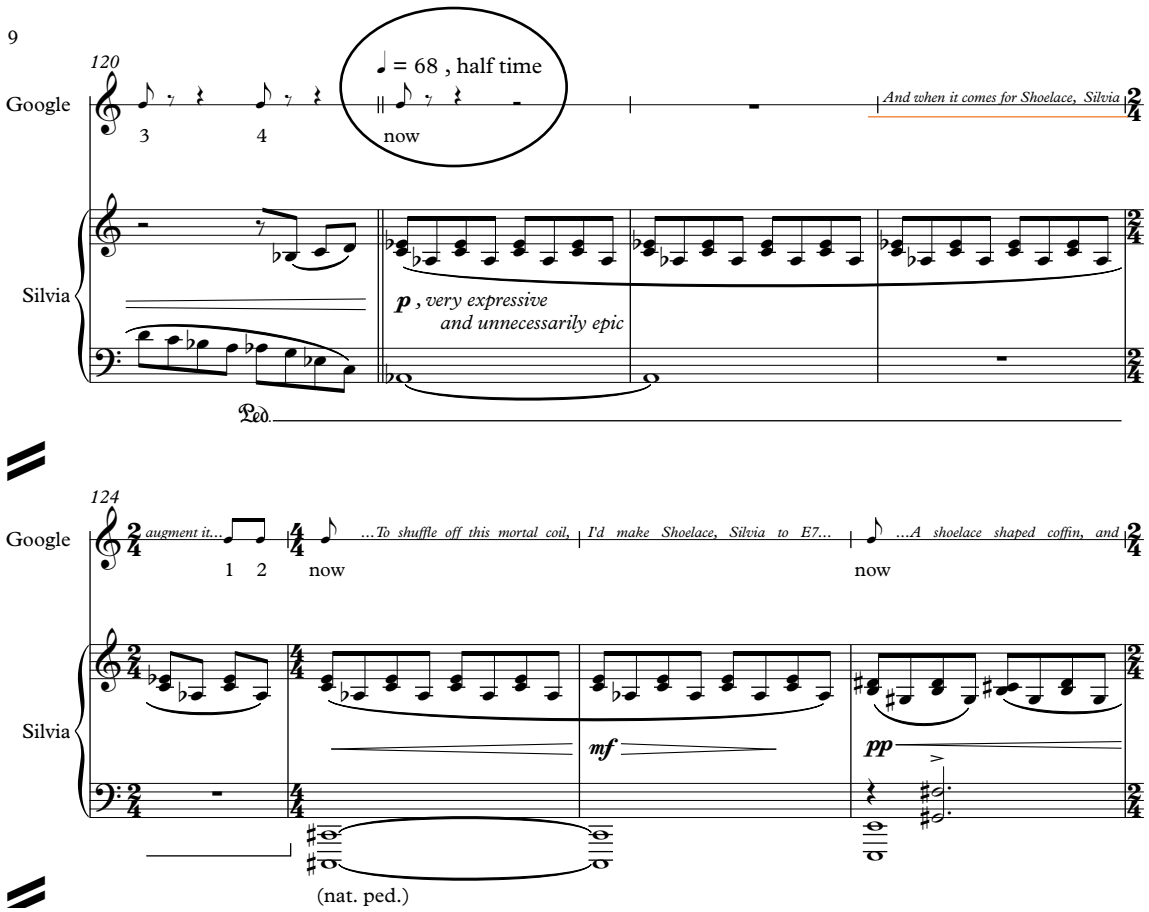
My learning process of this piece started with a special focus on the electronic track. While I was learning notes, I experimented with studying the electronic track separately. My rationale was to become familiar with the text and be able to anticipate events. For this, I followed the full score as I listened to the click-track in order to assemble a mental representation of the tempo and the (altered) rhythmical speech from Google.

Particular challenges arose as the learning progressed. I decided to continue working in two different directions: I played with and without the click-track indistinctively in order to determine how my synchronicity was improving. My main aim with this was to refine my muscular memory to successfully maintain evenly repeated quavers through a considerable amount of time. In this instance, I used a combination of click-track, no click-track and starting a metronome at random times in my practice so quavers would keep as close to the beat as possible.



Example 1.2.2: Repeated chords.

I also needed to be accurate in the only tempo change of the piece (b.121). This tempo change is a reduction by half, which has been previously announced by both Google and its notation. Theoretically, this should not present a challenge for any performer. The difficulty appears when adding the extra layer of electronics. There is no reassurance after the tempo change and total synchronicity is required in the second beat of b.124. This problem may be caused by the lack of rhythm representation in b.123. If there were rhythmic representations at this point I would have 4 beats to readjust my perception of pulse, providing a certain degree of security.



Example 1.2.3: Tempo change.

Uren's inspiration for this section was Pink Floyd's *The Great Gig in the Sky* (1973), especially its opening bars. This is also reflected by the performance indication of "*very expressive and unnecessarily epic*". If one listens to these bars in the song it can be noted that the pianist uses a certain degree of elasticity in pulse and rhythm in order to achieve expressiveness. In a similar fashion, I would aim for this 'freer' approach. Nevertheless, this kind of playing is not suitable for the tight synchronicity required. My performance solution for this had more to do with body language. In this instance, Dahl and Friberg state that: "[...]*body language*[...] serve(s) several important functions in music performance. It seems reasonable to assume that some of the expressivity in the music is reflected in these movements."[36] I aimed to be more expressive with my body movements making the audience feel this expressiveness from a visual perspective. In my video recordings, I show this by

[36] Dahl, S., Friberg, A. (2007, June 01). *Visual Perception of Expressiveness in Musicians' Body Movements*. http://mp.ucpress.edu/content/24/5/433.full.pdf html

rocking my body and head discretely according to the quaver chords. This creates a contrast with the lack of musical engagement performed in previous sections.

When premiering this piece, I played the work without click-track as suggested by Uren. I felt confident as prior rehearsals and practice strategies showed an overall improvement in the constancy of the repeated quavers in relation to synchronisation. As my research focuses on notation, I decided to perform with the score in order to examine how useful the notation was in actual performance. With these two parameters in this performance, I found that the notation of the electronic track was very reassuring. In this instance, after speaking to several members of the audience and Uren, they felt my playing was very synchronous. This may have depended on the acoustics of the room and where these persons were sitting. Nevertheless, when listening to the recording I noticed that there were small delays at these points: b.25-26, b. 53, b.57, b.61, b.71, b.77, b.96, b.119, b.124(example 1.2.3) and b.137. Most of these occurred at the end of sections and are a consequence of the way that we perform constant and repetitive patterns. Because of this, I decided to revisit this piece and perform it again, this time with the click-track. My intentions were to perform with concealed wireless earphones, however, the venue where I was performing couldn't support this technology, so I used normal wired earphones (not headphones) as discreetly as possible.

The second performance was more successful in terms of synchronicity. The click-track was quietly played so it wouldn't interfere with my reactions and would allow me to control my tone production as much as possible.

I compared both recordings looking for the level of accuracy of the most significative synchronous events in this work. Findings show that out of 40 synchronous events, I performed 34 of them accurately with the aid of a click-track as opposed to 24 in the first recording.[37]

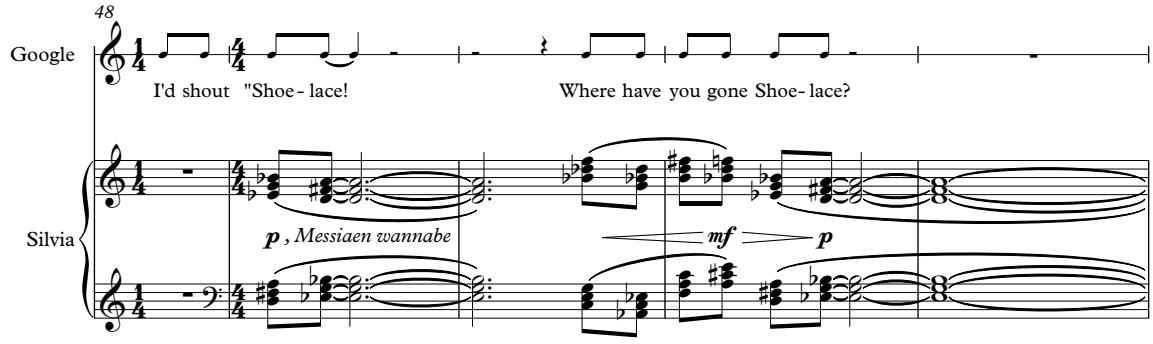
I also wanted to analyse how having a click-track would affect the theatricality of this piece.

[37] Annotated score can be found in this case study folder.

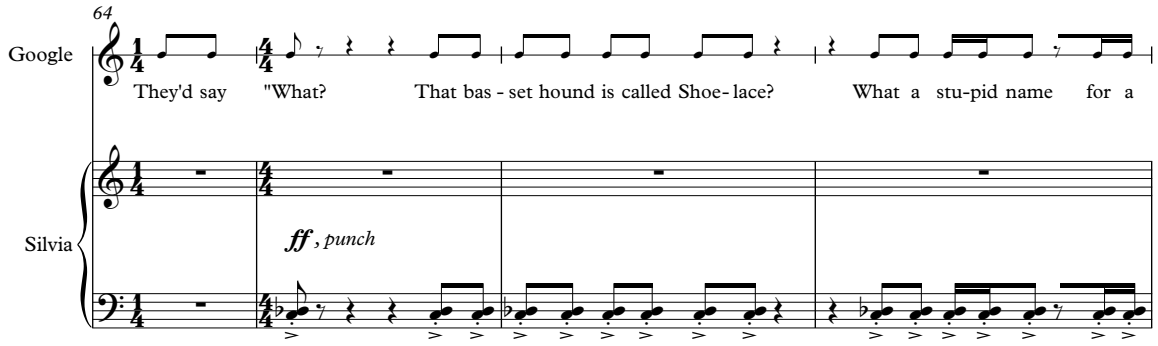
As mentioned before, theatricality is an undefined but required element in this piece. Even though these actions are not notated, they need to be conveyed in a convincing manner, not affecting the musical outcome. Uren and I discussed during rehearsal what elements would make sense in a performance situation. These are:

- Acting naively, almost a little confused by those instructions;
- Showing as few musical mannerisms as possible including: not counting or beating with my head and not accenting the first beat of any bar. [Excluding the last section (b.121 onwards)].[38]

The second instance required special attention to these sections:



Example 1.2.4: "Messiaen" section. B. 48-62.



Example 1.2.5: b.64-81.

I felt more comfortable performing with click-track knowing that I would not lose synchronicity as easily and could focus more on theatricality. On this occasion I was

[38] It is worth noting that, due to technical difficulties, the click-track did not work consistently and connection was lost at points. This reflected badly on the theatricality as I can be seen tapping my foot in order to continue the sometimes missing beat. For this reason, this performance solution cannot be considered successful.

not facing the audience so I had to re-think how to keep visual communication with the audience. I needed to exaggerate the theatricality of this set-up, this worked well as the choreography of these actions was previously rehearsed. I felt it was important to decide and prepare which actions are going to be used in performance as some of them (especially the lack of musical mannerisms) might result in lack of synchronisation.

The simplicity of notation in both parts can throw performances off, as the piano material relies on repetitions of what appears to be simple tasks such as chords or scales. The inclusion of verbal instructions of what is expected to be performed therefore adds an extra layer of complexity in the realisation of the work. The piano part is explicitly described to all the members of the audience. This increases pressure on the performer who needs to achieve total coordination with the electronics. These instructions will be conceived as easily achievable by the members of the audience and the pianist must react accordingly. In addition, the element of theatricality must be conveyed in accordance with the accurate synchronicity required.

In conclusion, my experience showed that the notation of the electronic track ensures a mostly accurate synchronisation. However, this can be affected towards the end of repetitive chord sections. Performing with a concealed click-track could make a more comfortable performance of the work as long as it does not interfere with the suggested theatricality. When performing from memory, the click-track can be considered the aural equivalent of the notation of Google's voice command. The combination of notation and the simple, yet accurate, descriptions of Google inspire a rigorous response on the part of the pianist. The score should be studied in great depth and the pianist should pay close attention to the script and its rhythm in order to provide a convincing performance of this work. This response is in accordance with the performative principles of precise notation.

1.3 Case study 2: Sergio Cote - *Dos Máquinas* (2017-2018)

Dos Máquinas was commissioned for my research. This work has been the result of a collaboration that started in October 2016. I have regularly collaborated with Cote during the last five years and have premiered some of his past piano works since then.[39]

Due to this rapport, I felt that this collaborative project would be a good opportunity to record this process through my analysis of notation and performance.

In this instance I was able to make requests. In addition, Cote asked me to assess the practicality of the technical aspects and its integration with the electronics in order to inform his research (in composition) as well as mine. In this chapter I will give an account of the collaborative process as well as a performance analysis.

After several informal discussions about the piece, we met up for the first time in February 2017 in order to set some ground rules.[40] My initial request was to include bespoke notations to the nature of the work, making this piece fall into the 'precise' category. I asked him to include a great amount of information on the tape material when he thought it necessary for performance. However, I wanted him to minimise redundant notations if he considered that detail would get in the way.

During our first conversations, I asked for a simple approach to the notation of piano material (including traditional notation if possible), so I could focus on how the notation of the electronic track affected my performance. My intentions were to facilitate the synchronisation process.

My ideas blended well with Cote's research interests. At that point, he wanted to experiment with how to notate musical gestures in a simplified manner as he had started applying this technique to his recent works. He also wanted to experiment with having pedals to trigger tracks rather than keeping everything in one long

[39] *Takay* (2013) Rhapsody for piano and orchestra and *Ceruse* (2014) Piano trio.
[40] This interview took place on the 3rd of March 2017 in Madrid.

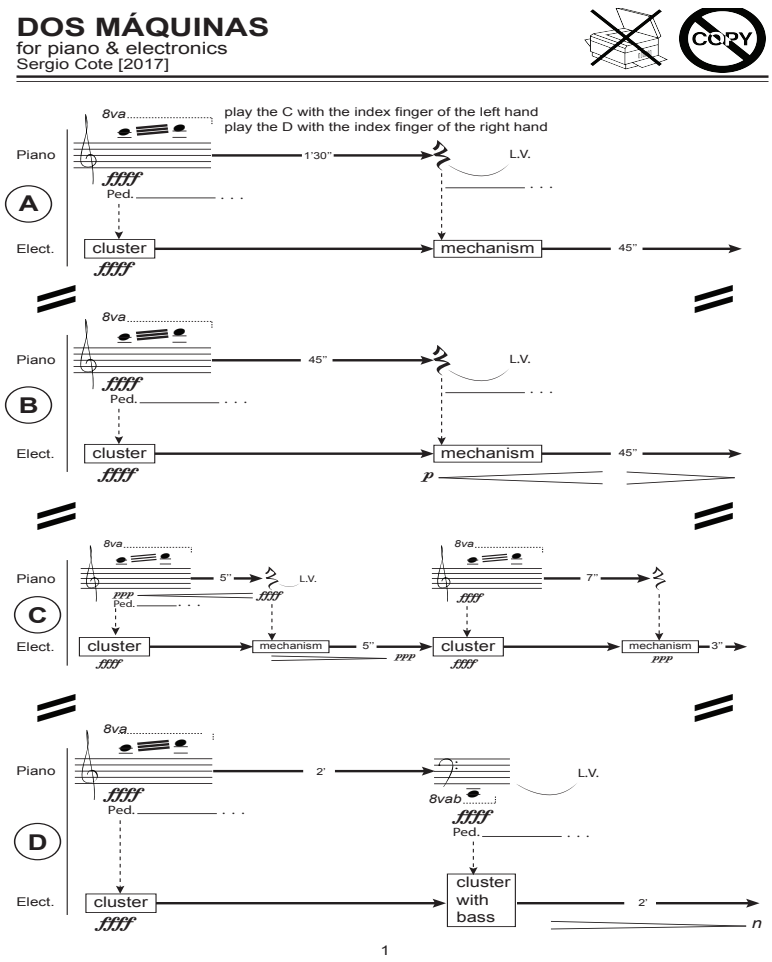
track, so that even if passages lost synchronisation, there would be several pick-up points throughout the piece.

With these ideas in mind, we met up again in May in order to check on progress.[41] As in previous meetings, Cote was still concerned with the idea of using a single track for the duration of the whole piece and wanted to investigate other ways of cutting sections down in order to facilitate synchronisation. There were a few options for this: using a triggering pedal, programming Max/MSP to follow me or relying on a third person to trigger these samples. At this stage, we both kept these options open but I also suggested the possibility of keeping the electronics in one track which would ease the composition process, rehearsal and final set up for performance.

In this interview, Cote mentioned using transducers inside of the piano. Eliminating loudspeakers was a very practical decision as the sounds would emanate from the piano itself and would help with blending and sound-checking.

In July I received the first draft of the piece.[42] It was a preliminary experiment on notation and sound amplification. I tried this at home with a pair of DAEX25 transducers stuck to the soundboard of an upright piano. In spite of some vibrations and rumbles, there was a good sonic result in terms of balance and sound quality.[43]

[41] Second interview via skype. 13th of May 2017.
[42] Received by email on 14th of July 2017.
[43] It is worth mentioning that the transducers were stuck to an upright piano and this caused some of the rumbling sounds. At that point we were experimenting with different adhesives in order to minimise this effect. Recording available in the accompanying case study folder.

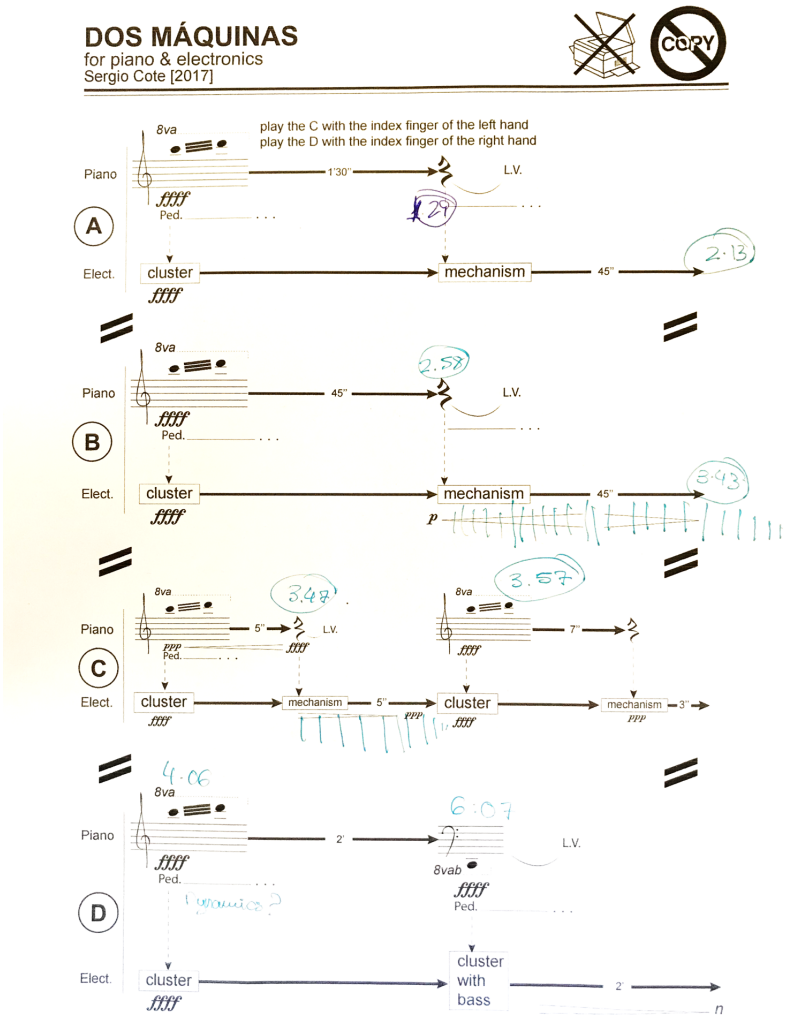


Ex. 1.3.1: First draft of *Dos Máquinas*. (July 2017).

The first draft was accompanied with questions from Cote. The most relevant to this research had to do with the notation and how it affected synchronisation. The track featured two main ideas. The first idea was a cluster of sounds emanating and dissipating at certain points, represented with a diminuendo marking in "D". Other sections did not present these markings which, in my opinion, was detrimental to the rigorous representation that we were aiming for. The second idea was to feature 'breathing' sounds that emerge from the mechanism of a player piano. These sounds are distinct in nature and they could have been represented quantitatively in order to maintain synchronisation.

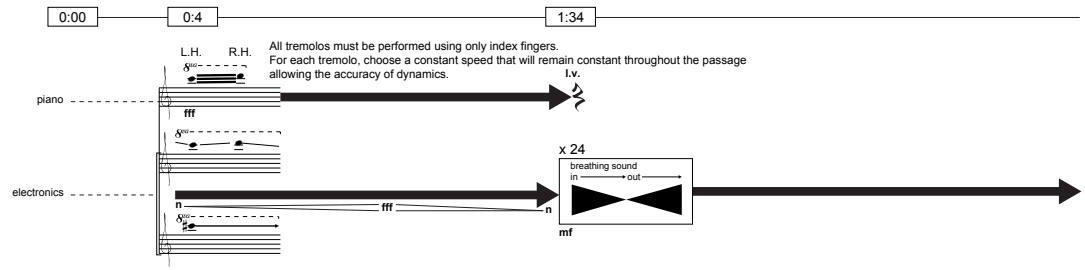
Time cues were represented exhaustively with regards to each gesture's length, yet, the continuous temporality was not acknowledged. This aspect was important to me at the time for practical reasons: in the end, the piece would need to be performed with a greater sense of continuity rather than mentally counting one or

two minutes at certain times. However, performing with stopwatch was not considered at this point.



Ex.1.3.2: My handwritten revisions from 1st draft. (August 2017).

In February 2018, I received the full score. Cote accommodated my suggestions and produced a highly specific score for both parts:



Ex.1.3.3: Excerpt of 1st section.

Motives from the electronic track are thoroughly described. The high pitch cluster is represented as a combination of all its sounds and its dynamics are detailed. The "breathing" sounds are represented quantitatively as well as graphically.

Time cues are used as event markers. They help synchronisation as they are specific to each event. It would have been redundant to have both time indications as I suggested previously. These indications made it clear that I should practise the piece with a stopwatch.

The first time cue at 00:04 corresponds with 00:00 in the main recording.[44] There is a practical reason behind this: Cote added the delay as it would help performing with a stopwatch. Therefore, I would be able to set the stopwatch off simultaneously with Cote and then start playing. For my practice, I used my phone (connected to transducers) to play the track and left it on the music stand for the duration of the piece. This was important as the time cues are highly specific and there was no option even to have a few milliseconds delay with stopwatches.

During final rehearsals this task did not work so successfully. The transducers got damaged during transportation so they did not work in the venue, this meant that I was no longer able to use my phone to perform at the venue. Had I performed with transducers connected to my phone there was little or no need to connect the transducers to the mixer. This way, I could have performed with the same set-up as I had used for practice. Synchronisation could have been achieved through my own phone and the balance between piano and electronics would have been equalised

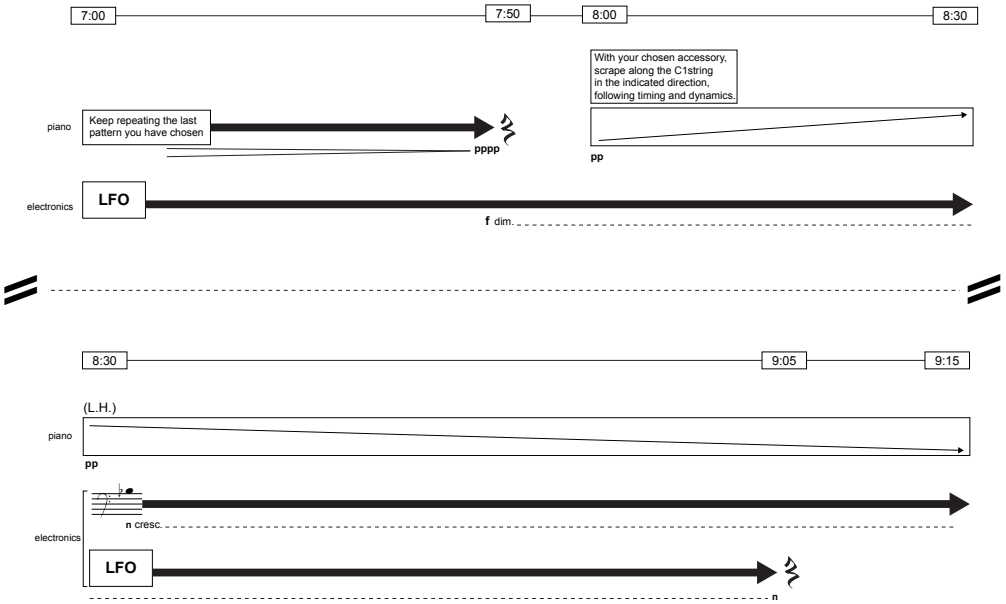
[44] Final recording available in the accompanying case study folder.

inside the soundboard of the piano itself. In order to solve this problem , we used two loudspeakers to either side of the piano. During my performance, Cote took care of the overall balance throughout the work. Subsequently, the task of synchronising stopwatches between Cote and I presented a challenge. Most times there was a delay of about half a second, as at that point we had to synchronise stopwatches manually. This resulted in very unsuccessful performances and the necessity to find a solution for the premiere.

We decided that the best solution would be to perform from the stopwatch at the main desk, so we needed to share screens in order to be fully functional. We used an application for Mac called Air Display which allowed Cote to share his screen remotely to my phone through a private Wi-Fi and Bluetooth connection.[45]

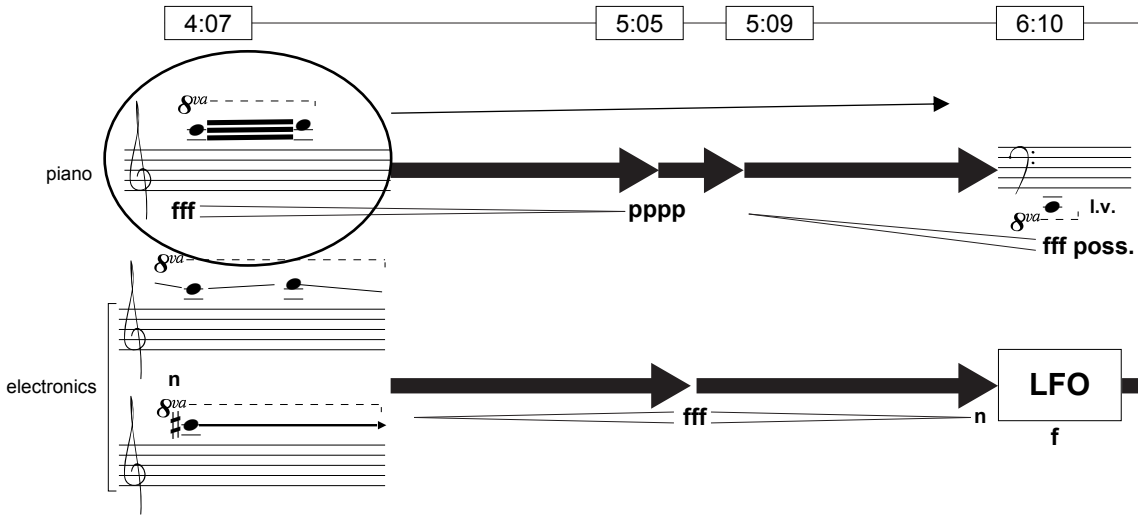
The placement of the stopwatch is important for performance. I decided to conceal the phone inside the metal frame of the piano on the left hand side. It becomes most useful in the second section (7:50) where there is a need for synchronised choreography (playing inside the piano). In this section, the notation of both electronic track and piano part informs performance and its practice.[46] The directional arrows in combination with the dynamic markings and given time cues inform the pattern (rhythm) and speed of the resulting sound in the piano part. This works in conjunction with the continuous arrows represented in the electronic track. The change of direction should be considered as a landmark for synchronisation and the sound should be as constant as possible, trying to minimise the break.

[45] https://avatron.com/applications/air-display/
[46] The object was a clipper soft lighter, chosen for its sound production and ergonomics.



Ex. 1.3.4: Beginning of second section (after 7:50).

In the first section, I used staggered dynamics in order to produce crescendos and diminuendos. This approach was most useful in the last instance of the trill (from 4:07 to 6:10), where I used it in intervals of 15 to 20 seconds so that the effect could be conveyed.



Ex. 1.3.5: Longest trill in first section. (4:07 to 6:10).

Technical difficulties arose during the premiere of this piece. Towards the end of the piece (at 12.09), the connection between my phone and the screen lagged for about one second and became unreliable after that point. This problem did not

occur when performing other pieces or during rehearsal. As a consequence, there was a minor delay in the performance of the last three events (from 12:09 to the end). Cote then decided to cut this section off the final recording, which left me with the question of whether it was because of how technology affected the delay in my performance or whether he thought this section was redundant.[47] Cote's response was:

> "It was an aesthetic choice. In terms of form, the piece was conceived in two parts: the first one as condensed energy, and the second as a release of that energy. After hearing the recording I felt that the released[sic] is accomplished right in 12:06."[48]

After the premiere, I was interested to see how my suggestions and involvement in the composition process affected the performativity of this piece. With regards to the use of a single track, I believe that my repeated suggestions made the performance process more strained. However, I still maintain that the level of accuracy in the notations of the electronic track would have been lower had we persisted with triggering samples. Likewise, the choice of a self-contained track informed Cote's conception of the piece:

> "I think that having the freedom that the samples entail would have allowed a more flexible performance. Nevertheless, the effort, or actual labour, of having a fixed track enhances the notion of risk as part of the aesthetic experience. It also reinforces the idea of the "*machine*" working with and against the human body; which permeates the entire piece."[49]

The performance approach that this particular kind of notation suggests is in accordance with the previous case studies seen in the category of specific notation. This notational technique translates into an extremely rigorous response from the player. In this case study, it has been proven that, even with the use of extra technological aid, this performance approach remains similar to other cases of

[47] The entire sound recording of the premiere has been lost in destructive editing.
[48] Email interview from 20/9/18.
[49] Email interview from 20/9/18.

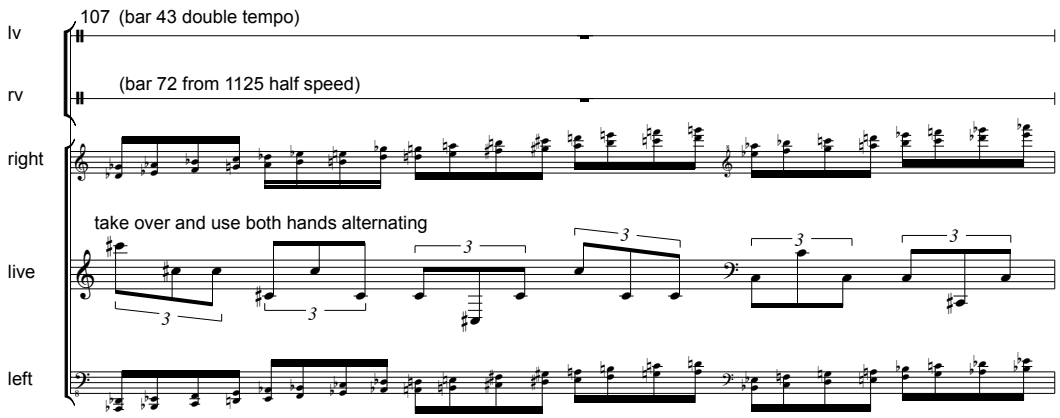
specific notation. The use of timer was crucial as the electronic track does not always present distinctive sonic landmarks and requires millimetric synchronisation. This also applies the concept of specificity in different notational contexts, as this piece has a graphic approach (partly, due to the use of extended techniques). In this case, a specific approach has been achieved in a work that features no time signature and where the approach to rhythm and pulse is reached from a mechanical perspective, relying on choreography and muscular memory rather than mathematical relations between rhythm, pulse and musical (motivic) memory.

1.4 Repertoire Example: Michael Beil - Key Jack (2016)

Key Jack (or *Key Jane* - alternative choice for female performers), for pianist with live video and tape is an effective example of precise notation, both in graphic and aural descriptions. This work is highly visual, its set up includes two screens at either side of the performer which will project alter egos that perform live processed video images of actions performed throughout the work.

Ex. 1.4.1. *Key Jack* set up.

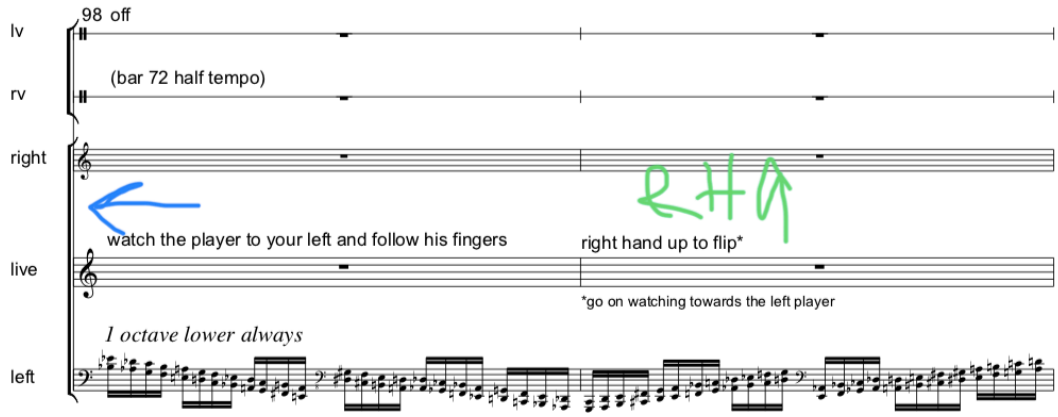
Key Jack presents a highly detailed score in its musical material through traditional notation which is mimed on a wooden board. The representation for tape materials is also notated traditionally as it is based on imitations of the initial material of each section. In this case, the use of the same style of notation evokes an accurate response from the performer because of the cohesion of notation and the precision of its material. The video elements are also notated in the score, they provide instructions for the video processing, which in this case is automatically managed by MAX/MSP. The video processing can also be done manually, for (non-live) recording sessions, following the instructions annotated on the *lv* and *rv* staves. It is important to note, that although the video in *Key Jack* is processed live, the tape material is fixed, so the performance of this work does not differ from fixed media.



Ex. 1.4.2: b. 107, notation of video (1st and 2nd staves), sound (3rd and 5th stave) and performance (4th stave).

The case of theatricality is essential to the performance of this work. These instructions are notated in text above the performance stave.
In order to fulfil the theatrical requirements, this work must be performed from memory. In its instructions, the composer makes the case for this as the first requirement. However, in order to accommodate this task, the composer provided a detailed click-track which provides timing instructions as well as reminders of material and theatricality/choreography.

The score, therefore, provides the primary point of access to the work. It is important for the performer to pay equal attention to the theatrical choreography as to the musical material as soon as possible. In my practice strategies, I highlighted timed choreography instructions as these are easy to misread or even ignore if one focuses solely on the musical material. This exercise reinforced my photographic memory and provided a short-hand graphic representation of the written instructions.



Ex. 1.4.3. b.98 Some of my annotations of head (blue) and hand (green) movements.[50]

These events must be performed as accurately as the musical material in order to provide a convincing performance of this work, so the effect of the alter egos is as realistic as possible.

In order to maintain continuity there are other theatrical elements to be considered such as the "basic position" face and hand placement, and ensuring the board for practice is 89cm in order to keep the same proportions for performance. Acknowledging the full size of the board will enhance the effect of section 4, where the musical material is being passed on to the two alter egos on the side screens.

Once the written script and musical material has been internalised and memorised, the click-track should naturally become the only score available for the performer.

The click-track focuses on various aspects, becoming an aural map of the work:

- Melody reminder: Different materials are labelled with evocative words such as scale, octaves or bass. The performer does not need to memorise the order of the sections, however it is important that the "musical" content of each section is memorised with the same detail as if it was being played on a keyboard.

[50] For full annotated score please refer to case-study folder.

- Theatrical audio-guide: the composer talks you through different positions and facial expressions on real time. This aspect is especially useful when changing between different hats.
- Pulse reminder: the metronome sounds are provided with a difference in pitch, so this acts as an enforcer of the melody reminder. As sections are approaching their end, the pitch of the metronome gets higher. In my experience, this created a strong connection for the photographic memory from the text score.

The additional click-track works successfully in this context as it does not obfuscate other aural interactions. This click track is essential to the preparation of the piece. I found that it does not promote unwanted musical mannerisms (such as tapping the foot to follow the pulse) because of its theatrical element, which needs to be carefully practiced. Theatricality is of equal weight to pianism in this piece, and therefore the use of click track is used both as a prompter and a metronome. Theatricality and pianistic playing should be practiced thoroughly so it becomes second nature to pretend to ignore the commands from the click-track. In this case, written and aural notations work successfully in order to assist performers, however the effective and simple notations could disguise the difficulty of the work. The detailed scores are extremely useful for performance and complement the learning process, but this work should not be considered straightforward by any means, especially as musicians are still not fully accustomed to performing with such theatrical detail among musical performances.

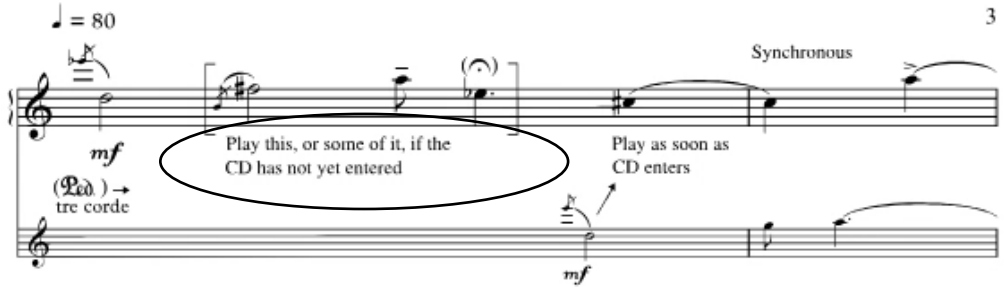
This case-study has served the purpose of pointing out that precise notation can be obtained in different contexts. In this case, the audio-score or click-track enhances and complements the precise notations on the score. This combination of audio and text score is bonded with exposed melodic and theatrical material which requires exact precision. The performative response that *Key Jack's* notation encourages is in accordance with the characteristics of precise notation. In this case study it has been proven that precise notation has been achieved by a productive relation of the written score and its correspondent click-track.

2. Hybrid notation

Hybrid notation presents a mixture of precise, imprecise and the absence of notation. This mixture can be presented at different sections of a particular work. The fixed media notation provides information of certain parameters. However, there might be necessary parameters for successful performance that are missing. The degree of information in this notation varies according to its context.

2.1 Repertoire example: Jonathan Harvey - *Tombeau de Messiaen* (1994)

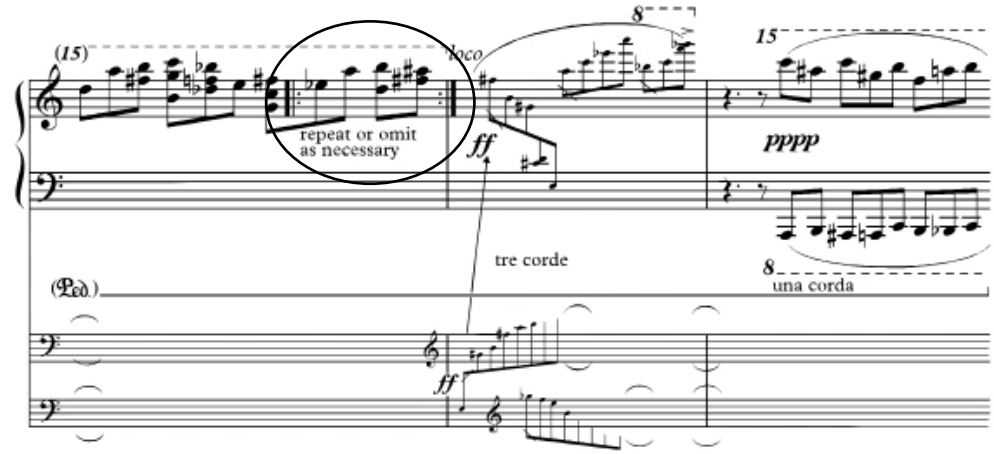
Tombeau de Messiaen was written in 1994 for Phillip Mead. This work provides an example of hybrid notation because the electronic track is not always accurately depicted. In addition, the piano material presents an open-ended approach, which allows room for repetition and omission in several moments in the piece when synchronisation might have been lost. The controlled improvisation varies considerably. Some of the written material is omitted as soon as the next audible cue appears, as shown in the example below:



Ex. 2.1.1: (1' 35") (p.3). Reproduced by permission of Faber Music Limited.[51]

It also appears as a repetition of certain material in a loop:

[51] Score lacks bar numbers. Following examples will be referred to as time notes from my recording.



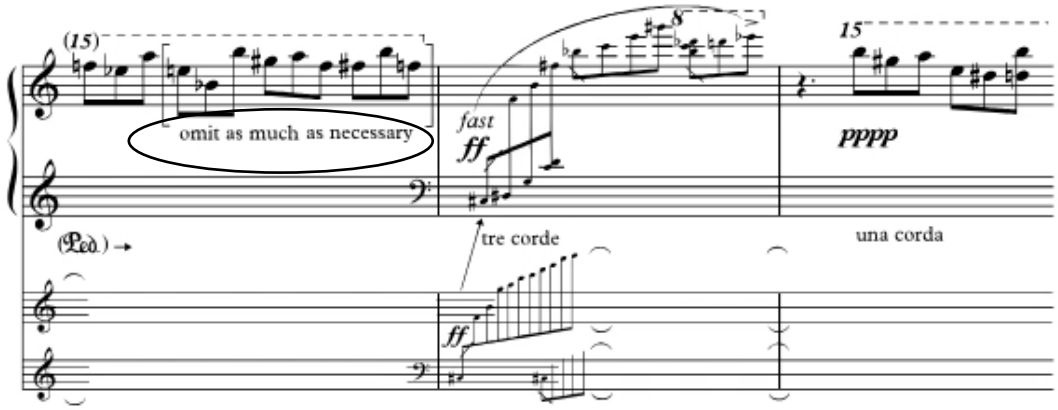
Ex. 2.1.2: (5' 28") (p.11). Reproduced by permission of Faber Music Limited.

Towards the end, the performer is given the choice of controlled improvisation:

Ex. 2.1.3: (8'05") (p.17). Reproduced by permission of Faber Music Limited.

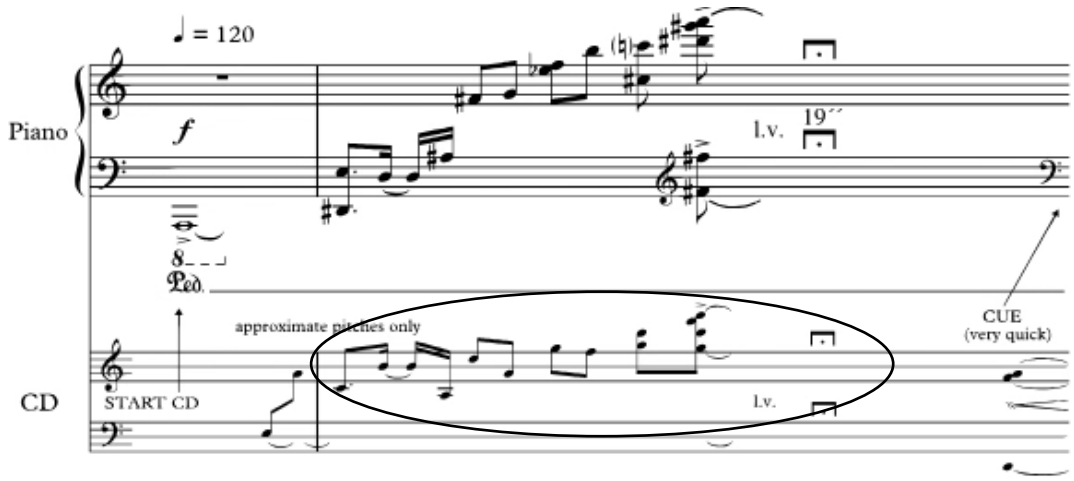
Having this elasticity allows the pianist to feel in control of their own part. It is not required to have strict synchronisation at all times. The freer passages give a sense of reassurance and a chance to relocate one's position. However, it is important to acknowledge this flexibility responsibly. The misuse of improvisation can threaten synchronisation, especially if the tape is ahead of the piano part. If this is the case, synchronisation will not be achieved and will be aggravated by the use of improvisation.

Consequently, in my personal practice I had to consider a wide variety of possibilities in order to achieve synchronisation with the tape: most of these actions had an aural and kinaesthetic nature. The tape notation suggests sudden shifts or omissions of material so it is important to acknowledge the reactive nature of the piano part.



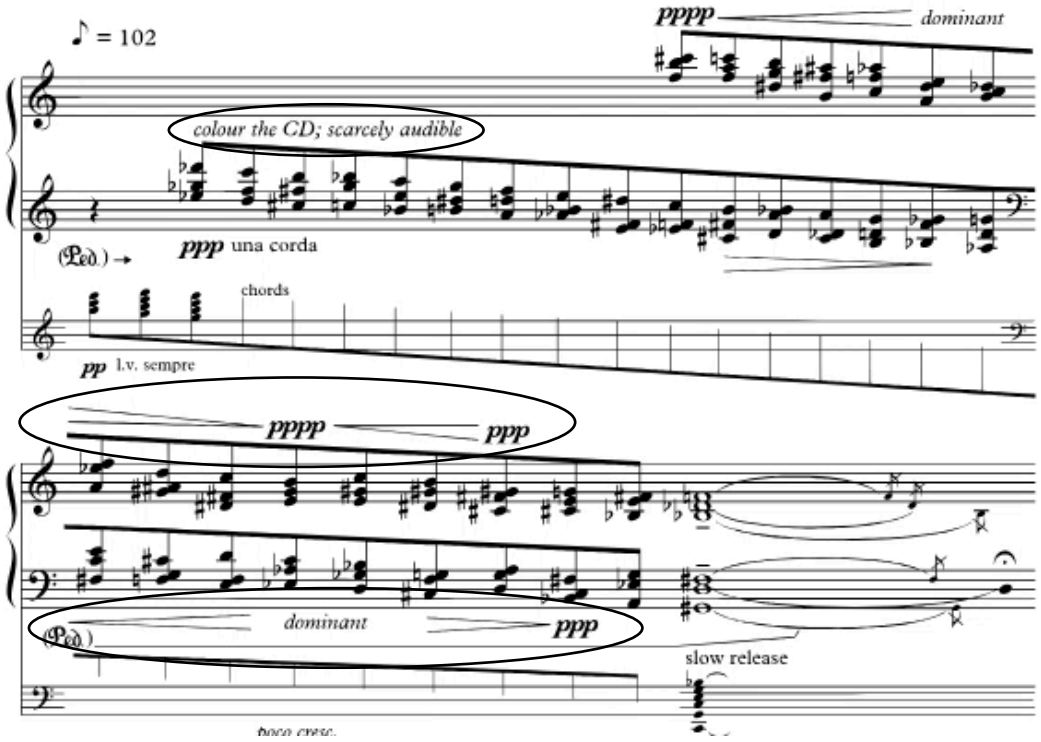
Ex. 2.1.4: (p.11) Possible omission of material followed by rapid shift to gesture. Reproduced by permission of Faber Music Limited.

The notation of the electronic track is sometimes very useful for familiarisation with its content. This is the case in sections where tight synchronicity or unison is required, such as in the following example.

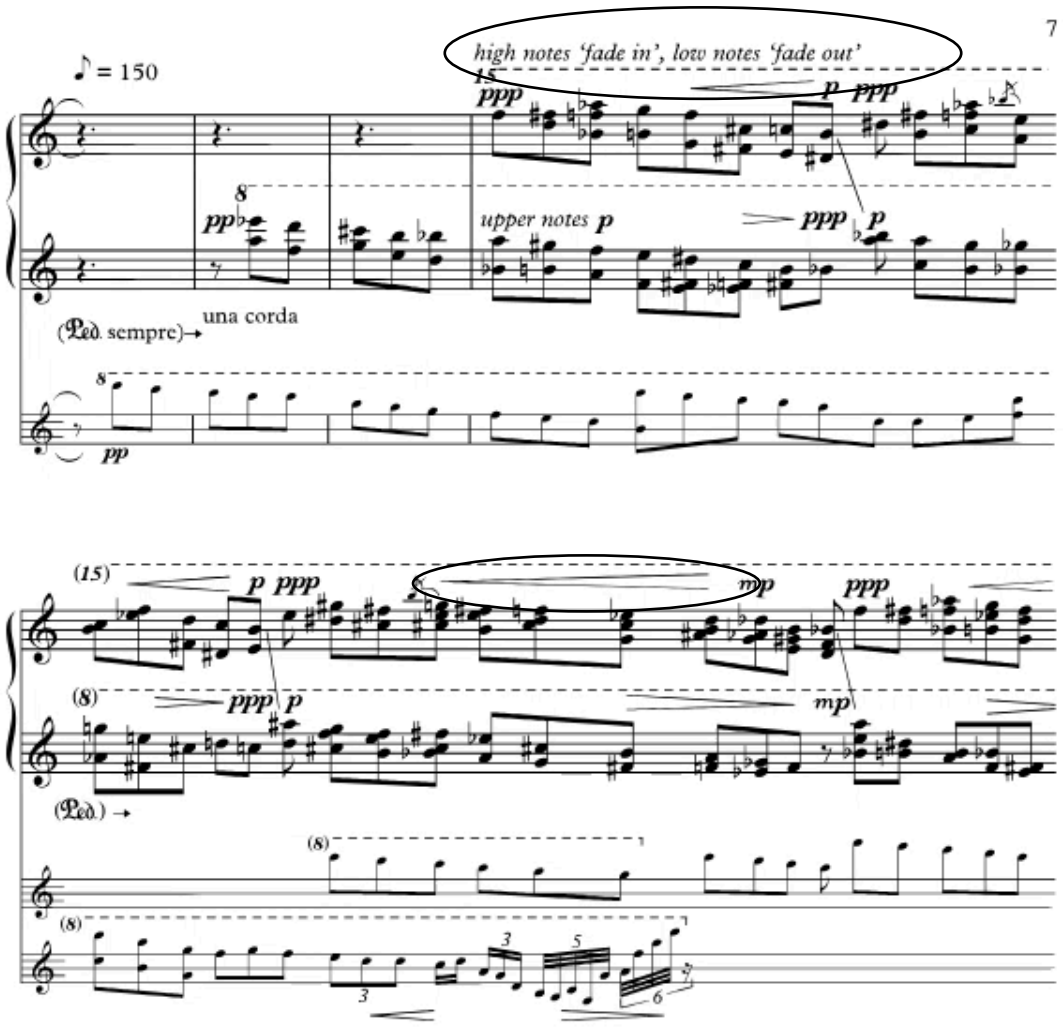


Ex. 2.1.5: (0'0'') (p.1) Very precise rhythmic notation with approximate pitch reference (DAT stave). Reproduced by permission of Faber Music Limited.

Synchronicity in this piece should also be considered in the level of dynamics and in the approach to tone production and touch. The material used in the tape part is formed by piano sounds that have been electronically manipulated in accordance with the harmonic series, converting the piano into a more spectral instrument. Because of this, the colours produced by the chords should blend with the electronic track throughout the piece (see example 2.1.6). In some passages of the piece, this approach becomes vital as the wrong colour and attack would affect the blending process. Even if the notes are played synchronously with the track, the outcome would not be seamless and would result in a lack of dynamic synchrony. This approach should be considered in these two examples:



Ex. 2.1.6: (2'14'') (p.4). Reproduced by permission of Faber Music Limited.

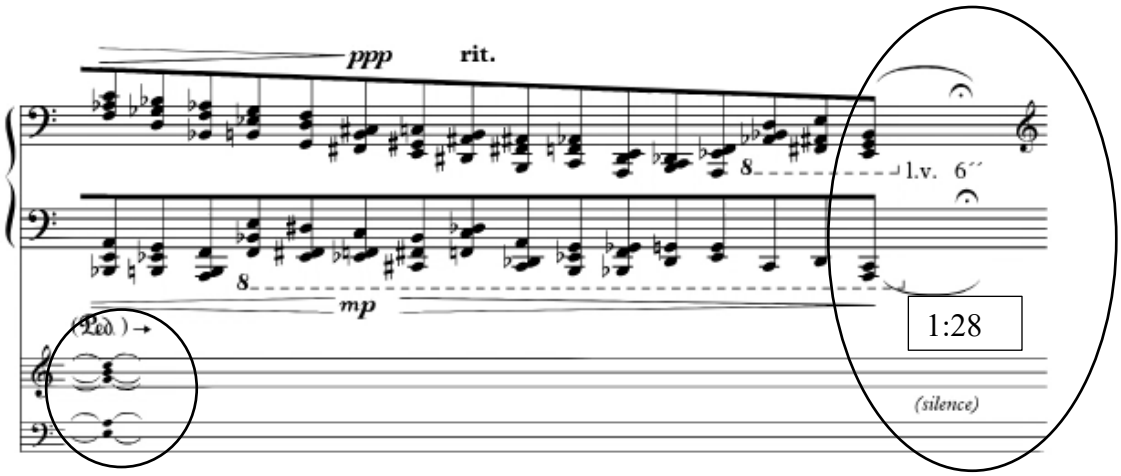


Ex. 2.1.7: (3' 30'') (p.7). Reproduced by permission of Faber Music Limited.

In these examples (2.1.6 and 2.1.7), each hand has a different dynamic direction. The different approach is meant for the performer to join in with the electronics in a more automatic manner, where each loudspeaker, or hand, works in complete isolation.

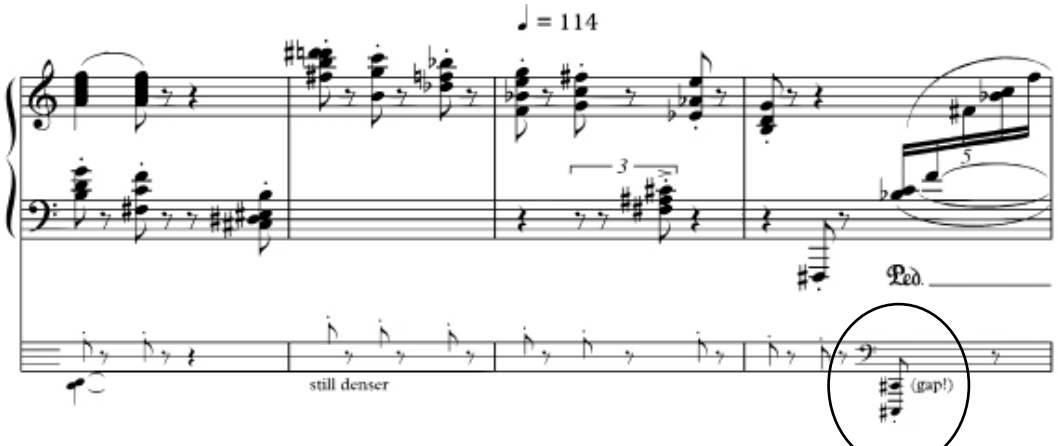
At times, the provided notation of the tape is not enough information for effective performance (see example below). Therefore, it is useful to annotate time cues as it facilitates practice and rehearsal of this work. It was especially useful when practising a particular section's chord voicing, tone production and synchrony.[52] In addition, added time cues are useful in transitions between sections where there is only resonance in the electronic track or silence.

[52] As seen in examples 2.1.6 and 2.1.7.



Ex. 2.1.8: Resonance and time cue (1:28) during silence. Tight synchronisation will be required in the next section (1:34) (p.2-3). Reproduced by permission of Faber Music Limited.

The notation of the section leading to the climax of the piece lacks some information for performance. This is the case on page 15 where there is supposed to be a gap in sound.

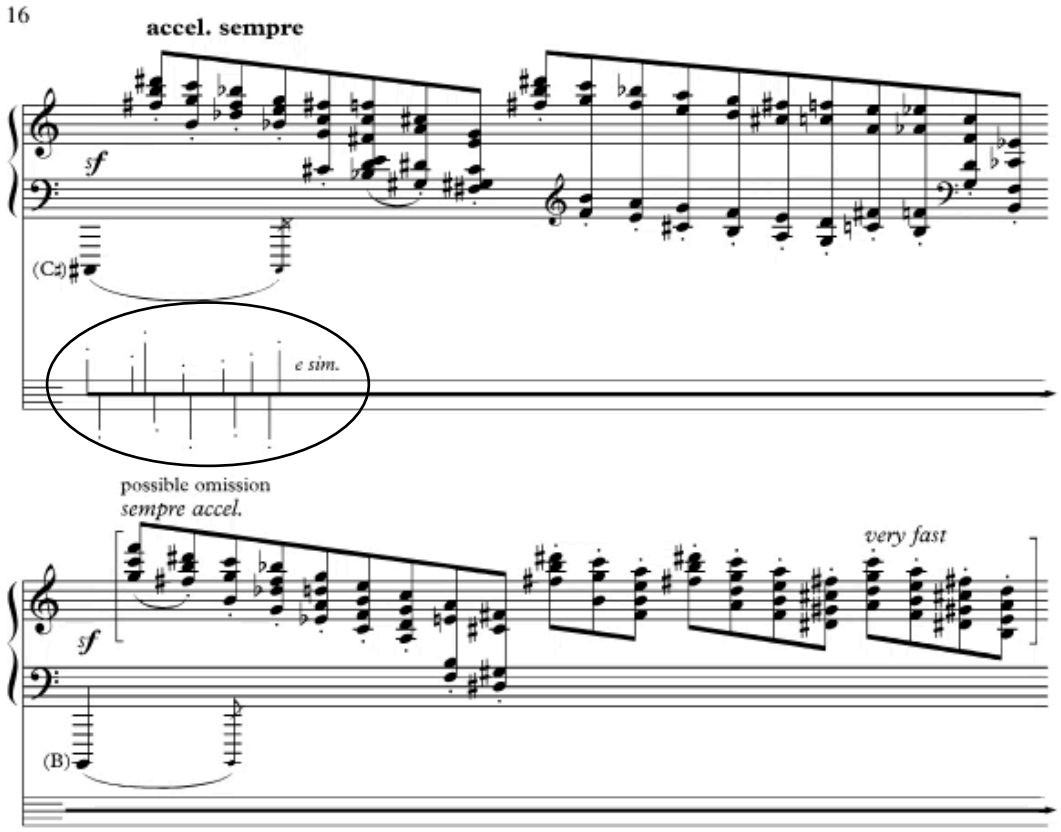


Ex. 2.1.9: (7'19'') (p.15). Reproduced by permission of Faber Music Limited.

This gap can be heard very shortly after 7'19''. However, this is not a distinct event that can be used for synchronisation. This gap is imperceptible due to the dynamics of the piano material and the resonances in the tape. It becomes difficult to discern when performing (even with the addition of a monitor speaker).[53]

[53] This event can be heard if listening only to the tape material with good headphones. The sound produced by the chords on the piano makes this aural event inaudible during performance.

From this point, notation for the rest of the electronic track could be considered ambiguous, as it does not provide enough information for effective score following. These are based on written descriptions of chord density and indeterminate staccato quavers. However, they could not be conceived otherwise, especially when acknowledging the *accelerando sempre* nature of this section. This means that there will be multiple performance solutions based on how the accelerando is approached. This notation reflects the flexible relation to pulse that happens in the piano part.



Ex.2.1.10: Ambiguous notations from 7:26 onwards. Reproduced by permission of Faber Music Limited.

Performance solutions for this include timing this section and practising all the events during the stipulated time interval, considering how the accelerando is going to be staggered (in accordance with the provided metronome marks) and memorising the last ten seconds of the tape material leading to the climax in 8' 05''. It would assist at this point to have more time cues, as the last "bell" chord (8' 05'')

on the tape appears suddenly after hearing the densest amount of material in the work.

The notation becomes more specific leading to the climax, which is in direct relation to the rigorous synchronisation of the event. Therefore, it is preferable to follow the events in the tape and leave as many gaps in the improvised chords as possible in order to relocate aurally.

With regards to the previous section (starting at 7' 19''), it would be preferable to have a graphic representation of the "mess of sound". These notations can interfere with the synchronisation process. At this particular point, it would have been beneficial to see a more detailed representation of the sounds, rather than a mixture of notation and written descriptions such as off-beat chords. The lack of exhaustive notation inspires a more aural approach which works best in quieter dynamic passageworks where the piano material does not get in the way of listening and reacting to the tape.

This leads me to the conclusion that performing this piece with a monitor speaker is crucial in bigger concert halls. In this instance, performances with the speakers positioned at both sides of the piano did not allow me to hear fully the electronic track and therefore, those performances were not as synchronous as I would have desired.

The mixed approach to notation informs how performance should be addressed. The combination between improvisation and rigorous playing means that the notation of the electronic track needs to be open-ended in order to remain effective. As explained earlier in this chapter, this means that, at times, notation should be enhanced with practical annotations and practice strategies that allow a controlled multi-temporal solution.
Controlled improvisation in this piece is conceived as a support element in order to remain synchronous. In addition, it encourages a more varied and open-ended resolution of the work in performance. The performance focus shifts from aural relations to rhythm and pulse in order to accommodate the approach to different sections.

2.2 Case study 3: Aled Smith - *i n t e r* - (2018)

inter – for piano and fixed media was commissioned specifically for this research project with its first performance taking place at Barnes Hall in Cornell University on the 24th of April 2018.

As with the other commissions for this research, Smith did not receive specific instructions or requirements on the composition of this work other than to utilise piano and pre-recorded electronics. After preliminary discussions, it became clear that the composer's intentions were to explore the notation graphically. This would highlight the notational aspect of the project, albeit in a completely different manner to other commissioned works.

After its premiere, Smith and I discussed the possibility of creating a second version which would include more detailed notations for the electronics. Smith, after expressing his dissatisfaction with the score decided to implement a new approach to the notation of both electronic and piano parts, as well as reconsidering the structure of the piece.

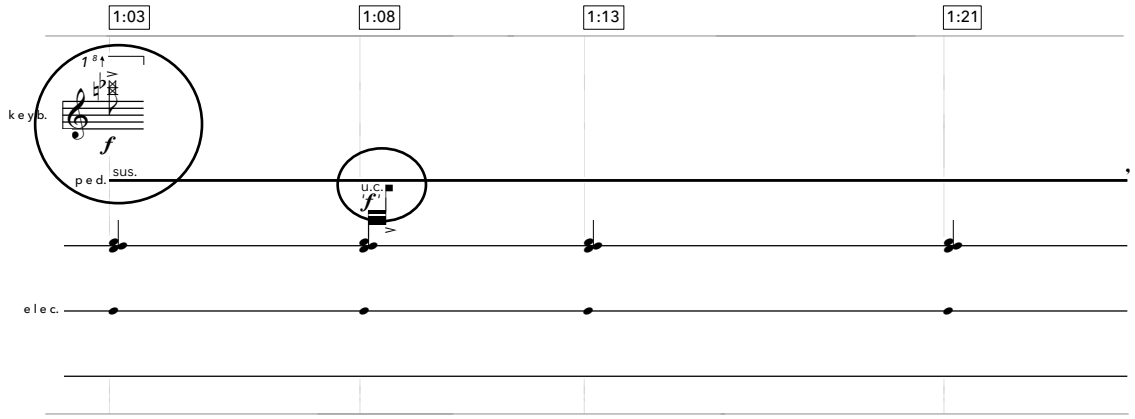
In this case study I will compare the performance implications of both versions of this piece from a notational perspective.

The first version of *inter* – features 5 sections. Each section can be considered as shifting perspectives on the approach around an 'object-space' and their production in performance.[54] The score presents a timeline with time cues throughout all sections. In its first version these cues relate to events from the piano part and to distinctive landmarks in the electronics.[55] In the revised version,[56] the approach to time changes: each page features exactly twenty seconds of material divided into

[54] 'Object-space' is a term used by Smith when describing his work.
[55] V_1 for the rest of the case study.
[56] V_2 for the rest of the case study.

one second intervals.[57] Aural synchronisation is not possible for the entirety of the work because of the intricacy of the material in the fixed media does not always present audible cues. Therefore, it is necessary to perform the work with the aid of a stopwatch.[58]

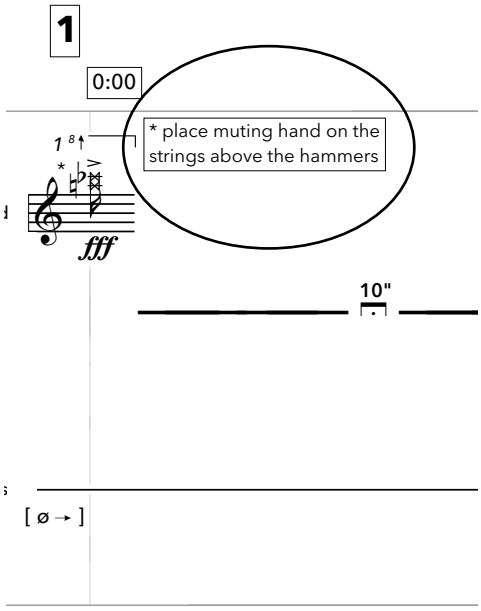
The most significant structural change occurs in the first section of V_1 (00:00-04:12) which is merged into a longer section of both first and second sections in V_2. In V_1 this section focuses on playing muted strings from the keyboard and different approaches to percussive use of pedal.



Ex.2.2.1: Muted strings and percussive pedal sounds. (P. 4. V_1).

Some performance issues arose immediately in terms of practicality, for example: regarding the approach to perform the muted strings clusters, there is this indication on the first page of V_1.

[57] The one-second intervals are not a suggestion of pulse. These time intervals are used for synchronisation and alignment with the electronics.
[58] Air Display https://avatron.com/applications/air-display/



Ex.2.2.2: Instruction on V_1.

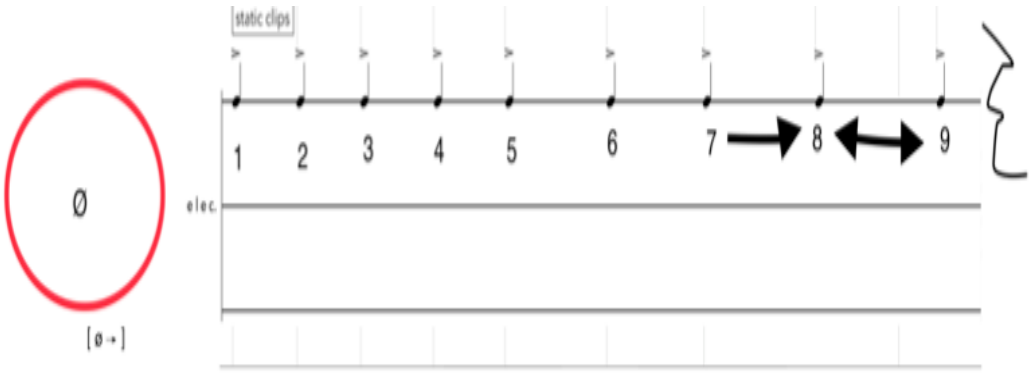
Synchronicity became difficult when muting strings with the left hand as the positioning of the stopwatch was problematic.[59] I annotated different approaches to the hit points in the electronics in my copy of the score in order to test whether the use of stopwatch was necessary. An aural approach in this section does not provide a consistent and successful performance solution as these points are isolated and abrupt. Additionally, the material of the fixed media is not suggestive of pulse which makes alignment difficult.[60]

In order to facilitate a solution, Smith and I decided to cover the upper part of the piano with blu-tack as the sonic outcome was acceptably similar. In V_2, the gesture evolved into a pitch-less attack.[61] This action helped with synchronicity and posture, as the first section of V_1 could now be performed sitting down. Synchronicity in this section should be regarded as rigorously as possible, with full attention to the stopwatch.

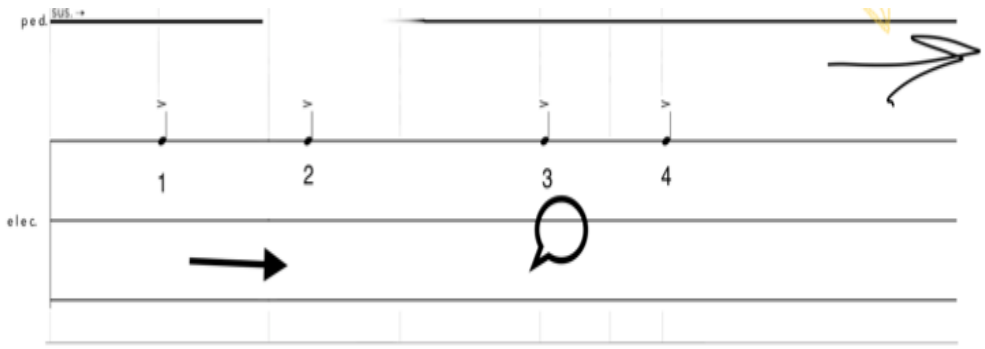
[59] The timer must be placed in the lower register metal frame. This will assist successful synchronisation for the last three sections.
[60] See p.4-12 of my annotated score in the appendix.
[61] In the live recording of V_1 I performed these attacks on the same register as agreed with the composer during rehearsals.

The second section of V_1 features an exploration of rasping sounds in different parts of the piano and diverse sonic approaches resulting from stroking keys and tuning pegs.[62] From the performance perspective, this section acts like a study on coordination due to the different nature of simultaneous tasks.

With regards to pages 12 and 13 (V_1), I added notations to the static clips from the electronics in order to represent the varying separation time between each one of them, the quantity of clicks and some of the sound properties as shown in the examples below.



Ex.2.2.3: My annotations represent the separation in electronics from 4.12 to 4:43,5 (p.13).



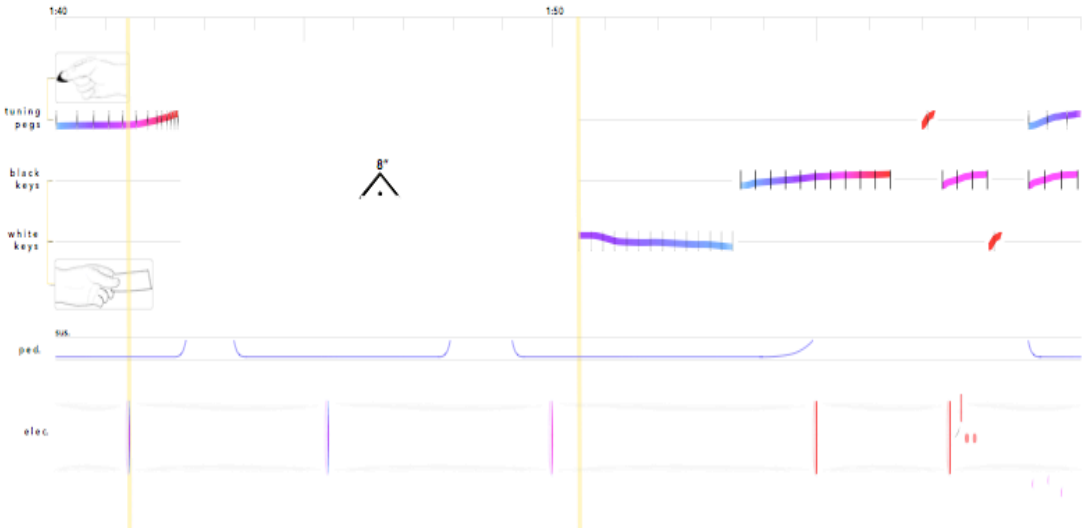
Ex.2.2.4: Annotations of sound qualities and distance of events (p.14. V_1).

These annotations assisted performance. Giving full attention to the timer was problematic due to the nature of the gestures and the constant movement between

[62] Corresponding to p. 14–16 on V_2.

different tones of the instrument. In this section, there is limited flexibility within the gestures. The square fermatas serve as landmarks or pick-up points where synchronisation is re-established. In V_1 there are square and triangular fermatas. Triangular fermatas are generally shorter (less than 3 seconds). I used these as quick check-up points, which meant that sometimes, for example from 4:41 to 4:56 in V_2, I would have to cut some of the gestures shorter in order to remain synchronous.

In V_2, this is no longer the case, there are only triangular fermatas which represent the longer breaks in V_1. The notation of the electronics is more accurate here as most events are fully described graphically. In this instance, the use of a time grid, the colour coded dynamics and the compact usage of notation in one page helps the focus for synchronisation.



Ex. 2.2.5: page 6 of V_2 (1:40-2:00).

With regards to the performance of the white key clicks with a card, I changed my approach from playing on the keys to playing on the edge of the keys (Fig.1 and 2). The aim was to achieve better control of the dynamic range and colour palette without pressing any keys down.[63]

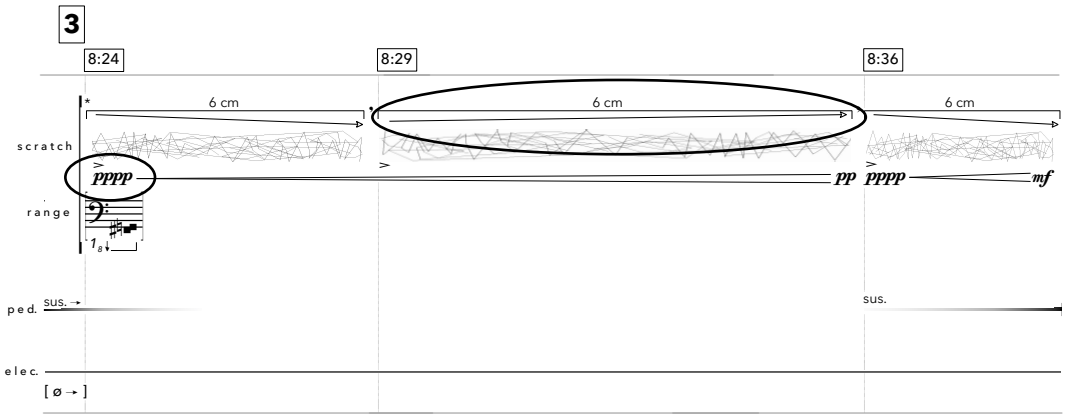
[63] In order to remain accurate it is important to avoid pressing the piano keys down. The desired synchronisation must result in a sonic extension of the electronics with the use of this technique.

Fig.2.2.1: Card approach during V_1.

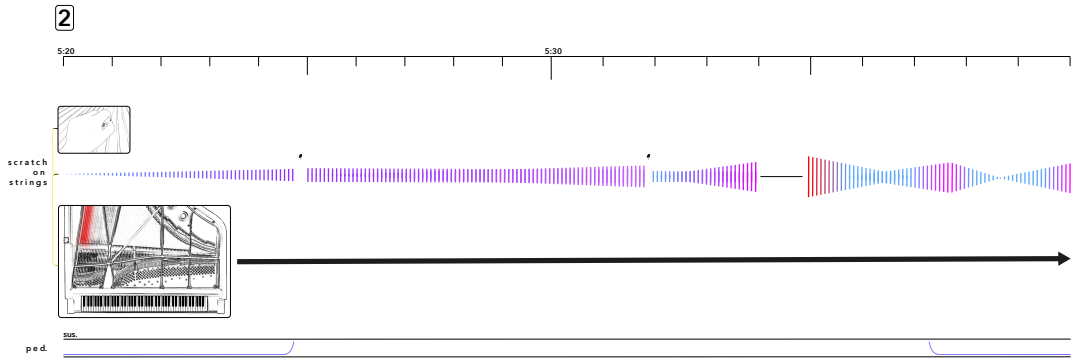
Fig.2.2.2: Card approach during V_2.[64]

[64] I experimented with this idea also because of the similarity of the sound approach from *Guero* (1969) by Helmut Lachenmann.

Section 3 (Section 2 in V_2) features an exploration of the distorted sound qualities of scraping the lower strings. The piano part enhances the material of the electronics, adding an extra layer of colour. Section 3 starts exploring the idea of complete blend between piano and electronics that develops in the last sections. Notation of the piano part is specific in both versions, however, V_2 presents a more flexible approach to pitch. The specific areas to address are highlighted in red so this material can be performed approximately (see Ex.2.2.7). V_2 provides the same degree of information effectively and economically. The performer can focus on tone production and synchronisation without other notational constraints. The addition of graphic representations of fixed media assists aural alignment so the performer is less reliant on the stopwatch. I would only look at the stopwatch near fermatas. This notational change therefore helped dynamic detail and blending as well as overall effect.

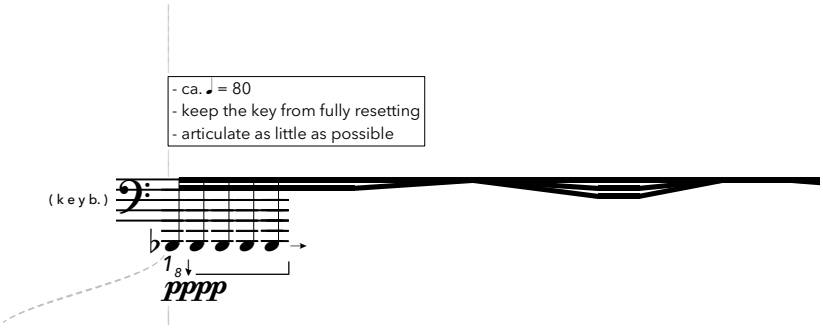


Ex. 2.2.6: In V_1, rhythmic and dynamic approach are described using areas to scratch (in centimetres) as well as conventional dynamic markings.



Ex 2.2.7: same material in V_2 (5:20-5:40).

The blending with the electronics becomes more evident with the addition of the repeated B♭ and B♮ which should still be performed with very little articulation as suggested in V_1.



Ex 2.2.8: 9:09 of V_1. Performance instructions.

Similarly, in section 4 (section 3 in V_2), tapping with fingertips on the strings adds a subtle layer of colour to the section. From the performance perspective this section constitutes a development of the techniques used in sections 2 and 3 (from V_1). There is necessity for high physical coordination between different approaches as well as the use of objects.[65] Due to this, notation of fixed media becomes more secondary, as performing these gestures take complete performative focus.[66] V_2 provides a good representation of its material, however this is most useful for personal practice because during performance, the focus will move towards the score and stopwatch relations. In either version, the performer will need to synchronise with a stopwatch. The tapping on the strings should blend with the electronics, acting as an amplification of the electronics from resonances of the piano.

The second recording (V_2) features different sounds of the wooden blocks as there was a second block near the lower strings.[67] This action meant that checking the stopwatch was easier. It also improved coordination between events.

The last section of the piece presents an examination of different approaches to playing on strings, varying from muted strings to harmonics. The fixed media

[65] These are two wooden blocks that can be replaced by heavy books (hit with spine).
[66] These gestures should be memorised for a clearer approach in performance, which will rely on coordination with stopwatch.
[67] This can be heard from 10:32.

notation in V_2 works similarly to its preceding section as it provides a great degree of information. However, this is not possible to follow in real time due to the intricacy of the extended techniques. In either version, regular time cues ensure the required degree of synchronisation.

With regards to muted strings, it was safer to mute more strings than necessary as accuracy decreases when adding the stopwatch element.[68] This approach did not work as effectively when performing harmonics, as the desired harmonics are located further down.[69] During the recording of V_2, we realised that it was more important to achieve a good harmonic colour regardless of the string it was performed on. This action enhanced the free approach to harmonics, especially as no partials were specified in either version. This action was beneficial to overall synchronisation.

The level of intricacy and complexity in the piano part must be considered thoroughly before attempting performance with the electronics. The amount of detail in the score can affect the synchronicity between the highly notated piano part and the lesser notated electronic track. This statement presents a dichotomy for the performer as the lack of detailed representations of the electronic track could suggest a freer approach to performance. Nevertheless, the use of irregular but detailed time cues invites an accurate response from the performer. The first version of the score can be considered within the boundaries between imprecise and hybrid notation because of the performance response.

With regards to V_2, the graphical approach to notation of both electronic track and piano material depicts detailed results in an innovative and more direct manner.

The evenly spaced time cues provide a more organised medium for performance of the notated events and the stopwatch element becomes an 'accessory' rather than an essential item for performance. This translates into a more flexible approach to

[68] This approach was also useful when performing successions of notes (such as 16:49 to 17:00, 18:47 and 19:49 in V_1).
[69] In an area of approximately 8cm from the dampers.

performance, allowing the performer to focus on more vivid communication while removing the need to worry about time. On the other hand, the flexible approach is not apparent when the score is approached from a theoretical perspective; it only becomes apparent when attempting this piece in performance. Smith's response is:

> "My work is designed so that material is created within a set of boundaries; temporality, gesture, pitch, effect, etc., which allow for a flexible and intuitive approach to performance. With *inter-* it was somewhat problematic to clearly articulate this flexibility within the notation owing to the inclusion of the entirely fixed electronic element. The solution is really in the markers at ten second intervals in the score, which act as anchoring points (temporal alignment boundaries). The material separated by these points can expand and compress allowing the performer a greater degree of interaction with the sound and ultimately a more personal performance as a result."[70]

After comparing both versions of the score from a performance perspective, it became clear that the second version provided a more detailed account of the material. V_1 provides detailed information for the performance of the piano part, however, it lacks clarity in discerning which events are to be fully synchronised as there is no detailed representation of the electronics. In V_1 time cues are not regular: sometimes representing events due to be synchronised and other times representing cues for the piano to enter. This is not a disadvantage in itself, however it requires careful analysis from the performer. V_2 presents regular time cues, however after page 26 the 20 second intervals no longer align with the decimal system up to this point (i.e. each page starts at 00:20, 00:40, etc.). This adds complexity to the process of synchronisation with a stopwatch; because of this, I annotated extra seconds in the time cues to assist my practice.

Recordings of both performances are similar in terms of accuracy. Both recordings were performed with the aid of a stop-watch as adding other aids such a click-track would not enhance the performance of this work. The most substantial change

[70] Extracted from communications between Smith and I.

was the notation ·which did not affect the quality of my performance.[71] Performing and preparing for the first performance presented a bigger challenge as the notation was less specific and required more time to learn in close collaboration with Smith. In the second performance the more efficient, updated score allowed for an enhanced response to the material facilitating an effective and confident performance. This underscores the importance of revisiting notation as a collaborative exercise in order to facilitate the performance of a multimedia work by specifically notating open-ended sounds of extended techniques.

The newer version adjoins between the limits of hybrid and highly precise notation. The notation in itself could be considered highly descriptive, however the performance approach shifts from rigid to limited flexibility. The material in the electronics allows a small degree of misalignment between parts (especially after the opening section) and it is conceived as a contrapuntal context (rather than homophonic) in its textural possibilities.
This case-study has served as an exercise on discerning how the revision of a work inspires different performance solutions. The differences in recording are not as quantifiable as in other case-studies, therefore the comparison and practice strategies have served as an example of the performance solutions inspired by each version of this work.

[71] As well as a shorter 1st section in V_2.

2.3 Repertoire example: Nicole Lizée – *Hitchcock Études* (2010- revised 2015)

Hitchcock Études: for piano, soundtrack and video is a selection of short pieces tied together under the narrative of various Hitchcock films. This work comprises 7 sections (or études) that present the same approach to traditional notation in both piano and electronics, however the melodic material and its development is different in every instance.

This work is a strong case for hybrid notation due to the variety of compositional approaches which require different responses from the performer. All of the approaches that will be described in this case study are to be performed with the addition of a click-track, with the exception of the introduction (or 1st section), which lacks click-track support in the first edition of the work.

The notation of the electronic track is described by the composer as: "an important component of the work. It is coaxing material from existing material by altering its physical state; illuminating hidden melodies, gestures and rhythms."[72] Indeed, the provided traditional notation in itself can be considered accurate as it represents some of the events that the performer will be hearing, however this research focuses on how the relations of notations and other tools (such as click-track) will complement and aid or obfuscate performance.
Synchronicity is not always granted by the use of click-track, however it generally keeps the rhythmical synchronicity tight. On the other hand, dynamic synchronicity is not possible without third party interaction. In order to perform this work live it would be necessary to have a sound engineer to equalise the sound levels of the soundtrack. My experience of recording this work proved that it was not possible to record both piano and electronics in the studio, instead the accompanying soundtrack has been superimposed in post-production which required the lowering of the levels the soundtrack in certain sections of the piece.

[72] N. Lizée. *Hitchcock Études*. 5

In this case study I will describe the findings after an investigation of both versions of this work. In order to give a more detailed account, this chapter will be divided into 7 sections.

1st Section: Introduction.

This section presents the most significant change from the first version to the revised version. In the first version, the click-track does not play until next section whereas in the revised version, the click-track starts at bar 14.
I have provided a recording of both versions in order to discern which approach was more accommodating.[73] Sonic result is similar in terms of synchronicity, however the lack of click-track provided a more comfortable response from me. In this section, there are certain tempo marks such as ritardando (b.21 and b.38-43) and tempo rubato (b.26-36) in addition to sudden and not too obvious tempo changes (b.18, b.28, b.33 and b.36) which suggest a freer approach to pulse. For this reason, I believe that the first version does not constrict performers unnecessarily and assists in the realisation of the passage work.

2nd Section: *The Man Who Knew Too Much* – Doris Day Étude

This section provides an accurate representation of the rhythm of the soundtrack. Sonic changes have been notated with enough detail in order to provide orientation for the performer in this repetitive section.
Click-track is essential in order to provide a synchronised performance of the section because of the meter changes. In this case, it does not obfuscate the performance of tempo changes (b.114, 115 etc) as these sonic events present a melody that ties these pulse fluctuations together.

[73] Recording of 1st version can be found in appendix folder.

3rd Section: *Psycho* – Stutter Étude

This works similarly to the last section with very precise rhythm notation. In this case the rhythmised words enable strong accuracy from the performer, which complements very well with the use of track.
It is important to note that b.229 lacks the annotation of the end of the click-track. This allows freedom in the last bars of the section; however this can be confusing to other performers as the composer did not clarify this in the score.

4rd Section: *Rope* – The party Étude (not included in first edition)

This section presents different degrees of synchronisation through the use of notation and click track. The first part of this section (b.233-247) presents scarce notational cues and lacks clicks, this is combined with the indication of *freely* in b.237 and 243 which indicate flexibility in tempo and pulse.
The next part of the section (b.249-277) does not present representations of the soundtrack, however the two transition bars with click track provide enough information for synchronous playing. This merges onto the last part of the section (b.277-310), which does provide helpful descriptions of the scale work that needs to be rigorously synchronised between soundtrack and performer.
In the last part of this section, it is worth noting that the 6 note chords in the left hand have been compromised in my performance, as suitable performative solutions can't be obtained at the indicated tempo.

5th Section: "*The birds* – Schoolhouse Étude."

As with section 3, the start of the click-track (last beat of b.323) is not indicated in the score. This challenge is compounded by the lack of beats to adjust to the new tempo marking. In my recording this can be seen as a fractional delay in the performance of these bars up to bar 335. It remains unclear to me whether this delay is intentional or acceptable, as the blending sound seems to be enhanced by this small misalignment. It is also worth noting that the rhythmic figuration is not always meant to be synchronous as indicated by the rhythmic notation of the soundtrack.

6th Section: *The Man Who Knew Too Much* – Phonograph Etude. (not included in first edition)

This section presents a similar issue to the introduction, where the presence of rubato and ritardando are obfuscated by the presence of the click track. I believe the click track becomes redundant from bar 438 onwards as the chords from the soundtrack are notated rigorously and present enough guidance for the freer but synchronous playing required.

7th Section: *Psycho* – Shower Étude

The first part (b.445-491) of this section works successfully in a similar fashion to the 3rd section. However, the second section (b.491-end) does not work successfully from bar 507 until the end. Here, the metronome mark changes are very small and almost unnoticeable, which obfuscate accurate realisation of the semiquaver ostinato. These changes are often too sudden, and the addition of the click-track does not assist synchronicity because there is not enough time to adjust to each change. The material in the soundtrack has been notated as constant quaver figures, however the rhythmic detail of these sounds allows for small misalignments as they are not clearly defined in time. In my opinion, this section could have been achieved as synchronously without the use of a click-track, using a freer approach like in the other sections of this piece. This poses a similar issue to the one stated at the introduction section.

Conclusion

There are different approaches to consider with this piece. In my experience performing this work, it was noted that there were a few problems with the addition of click-track. *Hitchcock Études* features melodies and materials that will need to be aurally blended with the soundtrack, but the click-track obstructs this task. It features an unmixed combination of the melodic material and the clicks, which can become excessive at times. In this case, the pianist will need to judge the dynamic level in practice and sound check and stick to those whilst performing.

The click-track has proven to distract successful realisation of quick changes of tempo, especially in section 1 and 7, where it could have been omitted in order to facilitate aural coordination. Therefore, this work features elasticity in tempo which should be considered as a hybrid approach. The performative response varies between strict and free synchronisation, however the style of notation suggests a strict approach. Therefore, these reasons highly suggest that Hitchcock Études should be considered within the range of hybrid notation.

3. Imprecise Notation

Imprecise notation presents little or no detail in representing the sounds of the fixed media. It frequently presents cues that ensure synchronous playing, however scarcely placed. This category also includes works that lack graphic representation of the fixed media.

3.1 Repertoire example: Luigi Nono - *...Sofferte onde Serene...* (1975-77)

...Sofferte onde Serene... is a well-established work for piano and tape. It is dedicated to Maurizio Pollini. This work is the result of collaboration between Nono and Pollini. The tape material features Pollini's improvisations in the recording studio.

The published score is handwritten and presents highly detailed indications in the piano part with regards to articulation, pedalling, tempo fluctuations and counterpoint. However, it lacks graphical and musical representation of the material in the tape. The only markers that acknowledge the presence of the tape are 8 time cues (named *riferimento al nastro*).

In this chapter, I will give an account of my performance experience with this piece. For this, I will compare three different recordings in which I altered certain parameters. I will also draw on the available literature on the performance of this work and how this research has influenced my performance practice.

The first source that is available for investigation is the recording made by Pollini, which provides a first-hand testimony of historical performance practice resulting from collaboration.[74] After having listened to Pollini's recording as a first study point, I decided that I should explore other possible outcomes rather than interpreting this piece as Pollini recorded it.

Paulo de Asis expresses the necessity of seeking original performances: "the performances of many pianists do not reflect the profound component of multi-temporality that pervades in the music. [...] The question of reconsidering the piece, of critically rethinking the unpredictability of sonic combinations for every new performance, remains widely unaddressed. [...] the[y] simply aim to reproduce

[74] Maurizio Pollini (1979). ...Sofferte onde serene... . [track 8] On Maurizio Pollini – Nono / Manzoni – Como una ola de fuerza y luz; ...Sofferte Onde Serene...; Masse. Deustche Gramophon. Europe.

Maurizio Pollini's timings following his recording for Deutsche Grammophon."[75] As mentioned before, I agree with Asis in the necessity for original performances. The main aim of this chapter is to provide original performance alternatives that focus on how the lack of exhaustive representations affects performance. Consequently, examples of how the lack of notations affected my practice will be addressed.

The multi-temporal element of this piece is dictated by the lack of exhaustive representations in the electronic track and by the constant changes of tempo. It is difficult to accept this element, as performing with tape generally means that one should be as synchronous as possible. Both statements are correct and complementary; the performer should find a middle ground for the realisation of this piece. For this, it is important to consider an exhaustive examination of the score and the tape material as a primary practice exercise.

I started my learning process in October 2016. My first recording was made in February 2017.[76] I aimed to perform as accurately as possible with the help of a timer in order to familiarise with section durations and to examine how efficient this tool would become in future performances of the work. I decided to maintain Nono's temporal cues and not to add any other timings. My reasoning for this was that:

1. I wanted to test the effectiveness of the notation;
2. It would be very difficult to predict exactly where I would be playing as pulse is elastic and fermatas are common occurrences;
3. I did not think copying Pollini's (or any other pianist's) timings would contribute to an original performance. At this point my hypothesis is that if the notation is open-ended, there must be different performance solutions.

Some findings appeared during recording. Performing with a timer was constraining at times. I did not account for losses of synchronisation; however these are clear at the end of the first section and before and after the 6th *riferimento*. Performing with stopwatch made the tempo changes relatively difficult as I tried to

[75] de Assis, Paulo. "Revisiting Luigi Nono's Suffered, Serene Waves." *Artistic Experimentation in Music: An Anthology* (2014): 203.
[76] Appendix recording as documentation of learning process.

relate them to 60 b.p.m in a mathematical way. This made me lose focus on the details of my part.

There is no indication from the composer on the use of stopwatch, however there are some references in the literature with regards to its timings. Berweck states: "What is more confusing is the beginning of the tape, since the electronic part on the Ricordi CD only starts at about 0.65 seconds and it is not clear whether the piano part should commence at the beginning of the tape, right on the first chord from the tape, or even later."[77] Moreover, he quotes Asis: " 'Nono never wanted'[78] the tape and the pianist to start exactly in sync, albeit without supporting this claim."[79]

Having acknowledged these references from literature, I concluded that this research should examine other ways of synchronising.

Paulo de Asis recognises a certain degree of flexibility in the performance of this piece: "a major feature of the piece is [...] the problem of synchronization. Nono, liberating the music from strict prefixed temporal grids [...] creates for this piece an extremely flexible system[...]. [T]here is room for flexibility in terms of vertical coordination."[80]

Aurally, I discerned events that accompany each *riferimento* in order to allow myself a more flexible approach to the temporal element of this piece. I created an aural map of events in order to add to the non existent representation of sounds and aim to eliminate the constraining element of the timer. Pianist Shiau-Uen Ding includes a similar account of her experience in this matter.[81] I am including my findings in this document as a complement to the already established literature. My aural cues are:

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[77] Berweck, S. (2012). *It worked yesterday: On (re-) performing electroacoustic music* (Doctoral dissertation, University of Huddersfield). 57

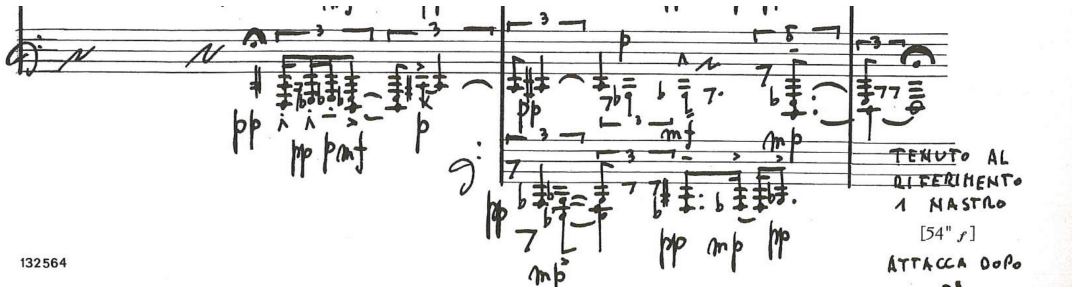
[78] Berweck on: 'einen auf Zehntelsekunden genauen gemeinsamen Start [...] hat Nono jedoch nie gewollt' de Assis, Luigi Nonos Wende. Zwischen Como una ola fuerza y luz und .....Sofferte onde serene..., 249.

[79] Berweck. 57

[80] Asis, 208.

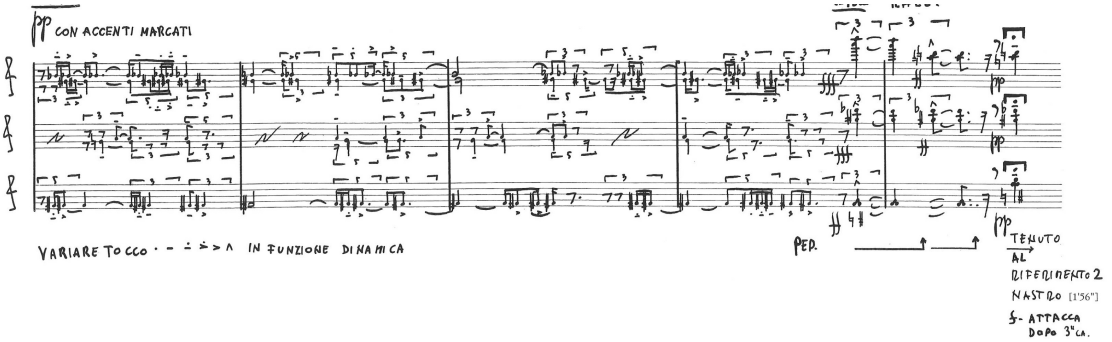
[81] Ding, S. U. (2007). *Sitting at the Piano, Cradled by Speakers: Developing a Rhythmic Performance Practice in Music for Piano and "Tape"* (Doctoral dissertation, University of Cincinnati).

1. End of 1st section: low cluster chord. Wait around 3 seconds:



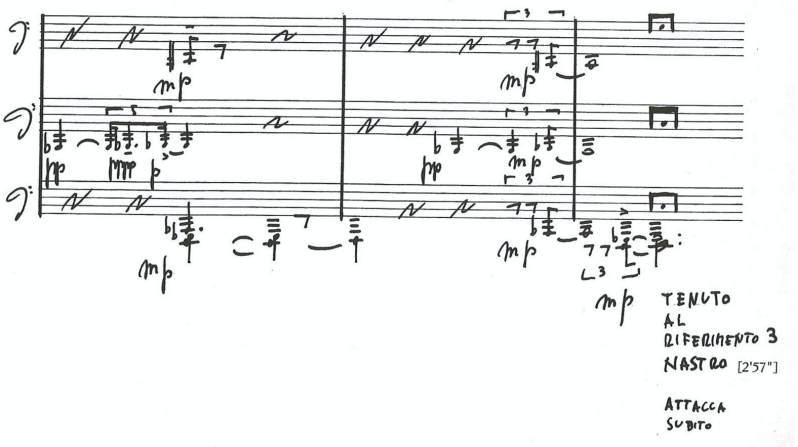
Ex. 3.1.1: (54").

2. End of 2nd section: Cluster chord at 1' 57". Wait 2 seconds:



Ex. 3.1.2: (1' 56").

3. End of 3rd section: quick acciaccatura between E, F# and B

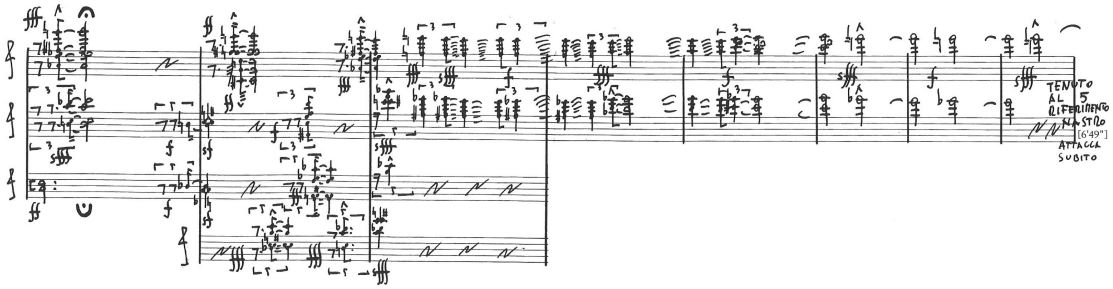


Ex. 3.1.3: (2' 57").

End of 4th section: Low B♭ in triplets, after this, the texture becomes much denser

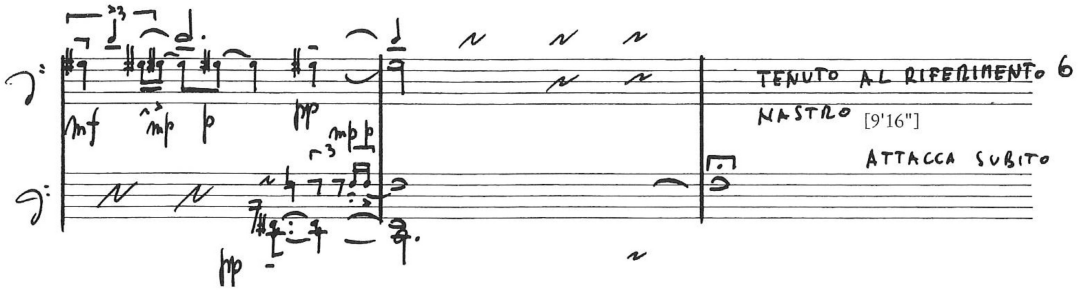
Ex. 3.1.4: (5' 11").

4. End of 5th section: Isolated, loud, low cluster around B natural and B♭



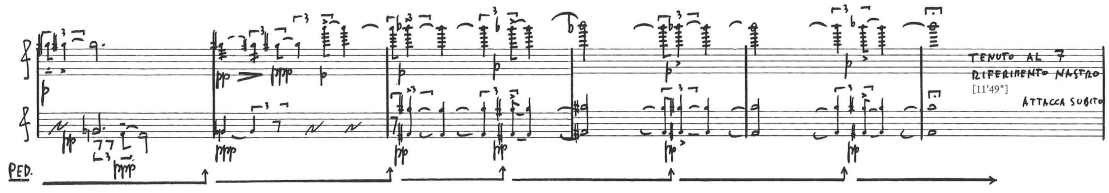
Ex. 3.1.5: (6' 49").

5. End of 6th section: Low E♭ based sounds and scale towards A7



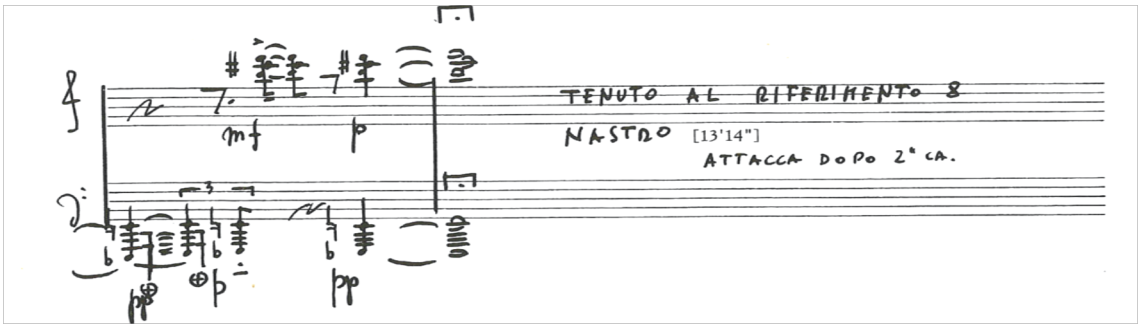
Ex. 3.1.6: (9' 16").

6. End of 7th section: silence followed by cluster of low D#, E and F



Ex. 3.1.7: (11' 49").

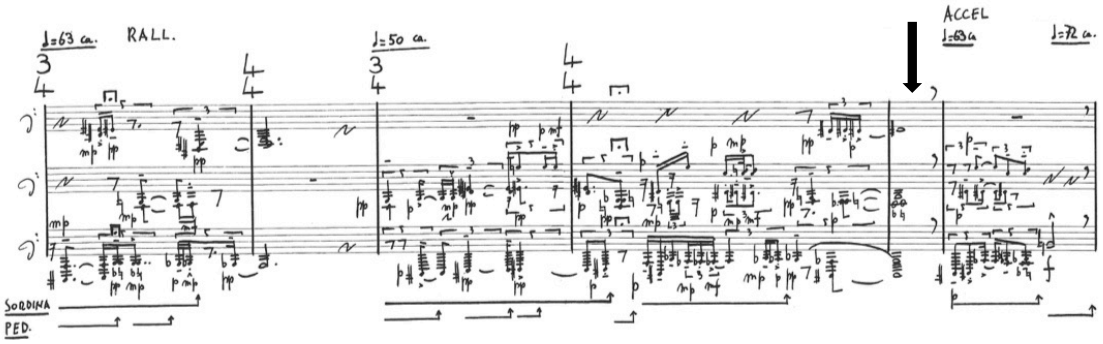
7. End of 8th section: gap in sound at 13' 15'' followed by a knock on a low string



Ex. 3.1.8: (13' 14'').

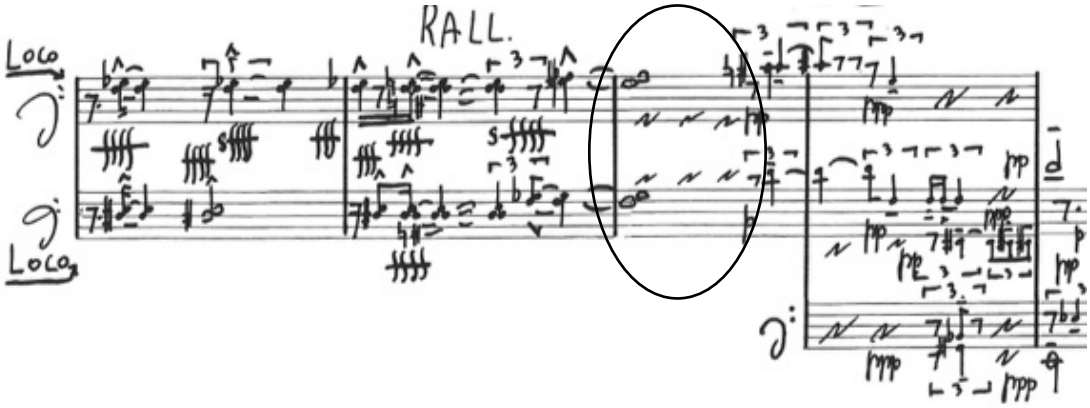
For further synchronisation, I noted other discernible events that help synchronicity. These are especially useful in longer sections and provide a certain degree of reassurance.

In this instance, I expect to hear 3 bell-like chords:



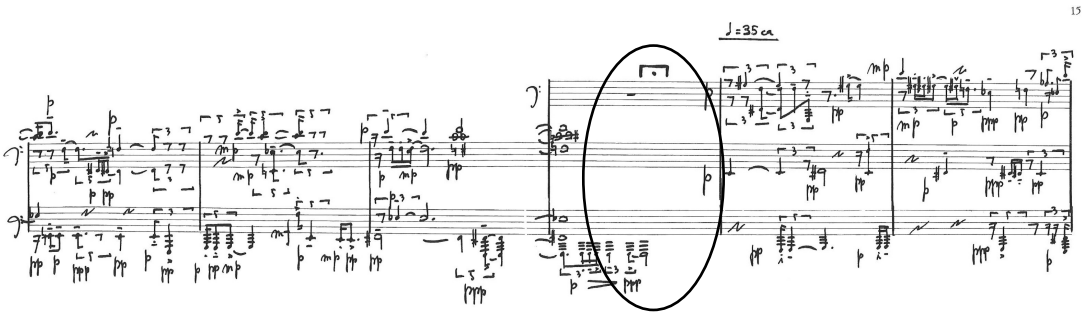
Ex. 3.1.9: Bell chords.

After the climax on page 14, I find the clusters in the rallentando as a small pick-up point and I continue to the following section after hearing the last isolated cluster.



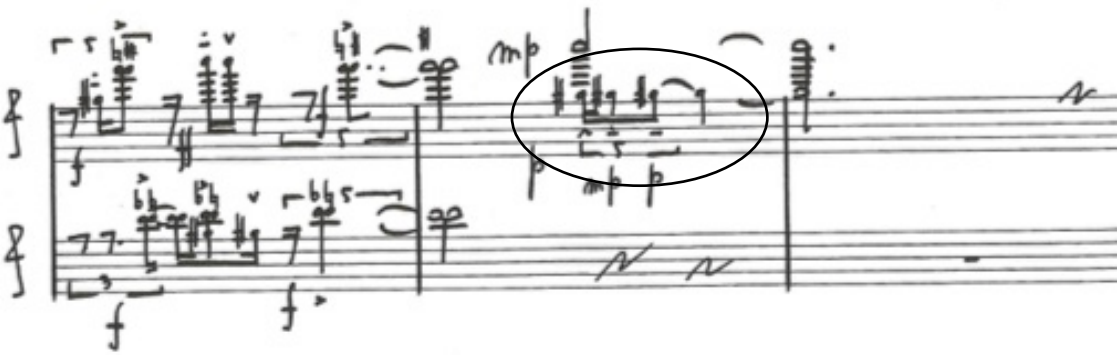
Ex. 3.1.10: Isolated cluster in tape at this point.

I observe the longer tape interlude in the fermata shown on page 15. It is based on F, F# and G. I continue playing after the last isolated cluster.



Ex. 3.1.11: Tape interlude.

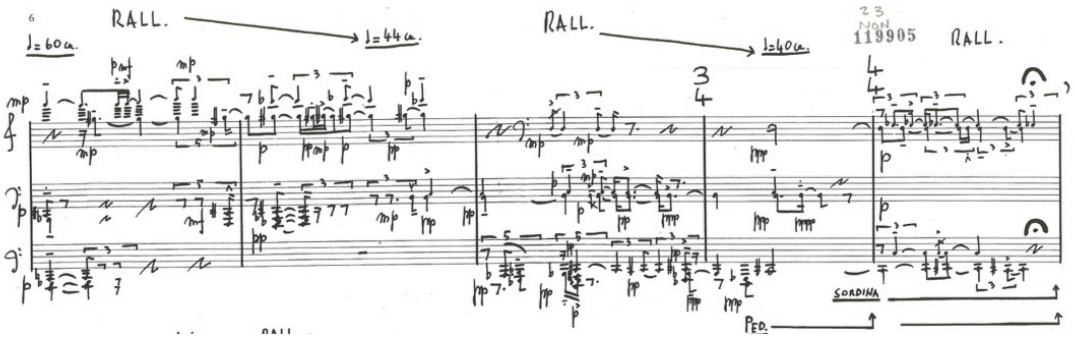
At this moment on page 16, the G# quintuplet echoes/anticipates the electronics:



Ex. 3.1.12: G# quintuplet.

These examples represent an attempt to provide notation that resulted from my own experience of learning and performing this piece. However, these do not cover

the entirety of the work; I use these as reinforcement for a freer and more open-ended performance.[82] I don't consider these aural markers infallible as there is still room to lose synchronisation. If my goal were to perform without a timer, I would have needed to devise additional strategies in order to be as synchronous as possible. Even though metronome marks are approximate, they need to be conveyed as closely as possible. Take the opening phrase as an example:



Example 3.1.13: Opening phrase through counterpoint.

There are three different metronome marks that result from the general rallentando towards the end of the phrase. The phrase that I perform goes between voices as shown in the example and it is broken down into two motives, with the last bar acting as a cadential point. I slow down at the end of the two bar motives, aiming to maintain a sense of pulse in the first three beats of b.1 and b.3. After memorising this phrase, I realised that I did not need to be quite as rigorous rhythmically (as the pulse is elastic); however the layering and placement would remain as written. This allows the proportions to be maintained as indicated by the rhythm. This approach would bring a more expressive performance, where the counterpoint of the three piano lines is acknowledged and the *rallentandi* are justified.

In addition to the changing metronome marks, there are different approaches to fermatas in this piece:

1. Round fermatas: normal approach;
2. Square fermatas: generally longer, can be used as stationary points that facilitate synchronisation at the end of longer sections and *riferimenti*;

[82] See comparative table on p. 78.

3. Phrasing fermatas: can be considered commas and/or elongations of last notes. These inform *rallentandi* when juxtaposed.

My second recording of this piece corresponds to a live performance in Barnes Hall (Cornell University) in April 2018.[83] For this, I applied my findings so that it was based on aural responses to the tape material. The tape is played through four speakers which are positioned in accordance with the instructions in the score.[84] I experimented with having a monitor next to me; however this was not necessary as the two speakers underneath the piano served the same function.

In this instance, synchronisation significantly improved. There was one major incident at the start where the levels from the lower speakers were significantly quieter than in rehearsal, so I found it difficult to relocate myself after the first fermata (b.5). There was also a lack of synchronisation at the end of the 6th section. This was incidental to the excessive approach that I applied during *ritardandos* and fermatas. I had to resolve this by not performing the last 3 chords and skipping to the next section as soon as I realised the latency.

For this recording, I outlined the different strands of the counterpoint more obviously. It was important to convey a more successful realisation of the different lines of the score. As mentioned before, the piano part presents great detail in its counterpoint and articulation. Consequently, phrases were performed without constraints in this recording. Generally, the sense of pulse and approach to tempo was performed more intuitively. Section 5 was performed faster and with a rushed approach. However this did not affect overall synchronicity. Therefore, after having studied the aural cues there was room for a certain degree of spontaneity and readjustment.

My conclusions after this recording were twofold.

1. I was aurally reliant: the tape levels had to be similar to the piano at all times.

[83] This recording can be found as the first recoding in the correspondent case study folder.

[84] Nono. 1977.

2. The problem with synchronisation was not fully solved: at this point I could justify this as an acceptance of the multi-temporal element. However, Nono notated those time cues as specifically (without the word *circa*) as he notated the piano part. The flexibility should be conveyed within sections rather than as a whole in this work.

I gave this approach a further opportunity in a live performance.[85] Accidentally, the level of the tape was much louder than I expected. In rehearsal, I had aimed for the same levels as the last performance. Time cues were conveyed more accurately at the expense of the overall balance. However, some of the time inaccuracies remained.

The third of my recordings is an attempt to correct all these imperfections. My initial parameters were as follows:

1. I would use a stopwatch, however I would only be allowed to glance at it briefly during the end of sections or while holding long notes in order to ensure synchronicity as well as musical detail;
2. the level of the electronics would be significantly lower than before, aiming for that (con)fusion described by Nono.[86]

My findings were that the stopwatch provided enough reassurance. However, in order to acknowledge the multiple temporal solutions I decided not to annotate any further timings on the score so I could follow an intuitive approach. The most significant difference in this recording is that the ends of sections 4, 5 and 7 are performed considerably faster and are more rushed than in the previous recordings. These conclusions are drawn from a studio recording (performed in one take), rather than from a live performance session. I believe this makes a significant difference with regards to the other recordings (performed publicly) as I had the option to restart recordings if the result was not as intended.

[85] Lecture-recital given as part of HARPS. Doctors In Performance conference held at the Lithuanian Academy of Music and Theatre on the 5th of September. 2018.
[86] Nono. ...*Sofferte onde serene...* . 3 (term found in Technical notes for the sound engineer).

In this recording there is more gain towards the piano in terms of balance with the tape. I was using the original set up proposed by Nono so I decided to increase the level of the speakers under the piano. This action did not affect the overall balance. In some instances such as 4:08 and 8:54 it contributed to the intended (con)fusion effect providing alterations of pitch.[87] More importantly, it provided me with enough aural reassurance not to have to be reliant on the stopwatch.

Berweck's thesis describes the conflicts of the translation of tape material into CD format and how this might have affected performance. As Berweck points out: "this edition [Ricordi] is now used by pianists and the musicological community for over two decades, which unknowingly produces interpretations and performances of the piece that are far from those intended by the composer."[88] At present, the Ricordi edition of the electronics is the only one available. In my accounts of performing this work, I have used the CD provided with the score and assumed that timings were in accordance with those described therein. In all my recordings I have assumed 00:00 begins at the start of the first piano note in order to fulfil the timings provided by Nono.

After comparing three recordings, it can be seen that there is room for different performance solutions. There is only a small variation in most timings, however, the third recording showed the closest timings to those indicated in the score.
The third recording provided the most exact timings in relation to the *riferimenti*, however stopwatch should be used discreetly as it can obstruct musical detail and suitable blending. In all the recordings, the main approach for synchronisation was aural.

[87] G# quintuplet (ex.3.1.13)
[88] Berweck, S. 63

Recording no.	1st *Rif. 54"*	2nd *Rif. 1'56"*	3rd *Rif. 2'57"*	4th *Rif. 5'11"*	5th *Rif. 6'49"*	6th *Rif. 9'16"*	7th *Rif. 11'49"*	8th *Rif. 13'14"*	Total timing
1. Cornell University (Apr-2018)	0:56	1:54	2:46	5:03	6:49	9:08	11:50 (Late)	13:03	14:00
2. LMTA Vilnius (Sep-2018)	0:55	1:53	2:47	5:06	6:44	9:07	11:51 (Late)	13:02	13:53
3. RNCM studio rec. (Oct-2018)	0:54	1:55	2:54	5:09	6:49	9:10	11:49	13:07	13:50

Table 3.1.1: Comparison of timings.

My main conclusions after this case study are that the absence of exhaustive notations of the tape material promotes a flexible and aural response for the performer. The issue of synchronicity becomes more secondary than in the other categories. However, synchronicity needs to be conveyed to an extent that will provide a timeframe for the realisation of the piano material which will inform the rhythmic pacing. The fact that Nono did not consider making the tape material flexible (live electronics) provides enough constraint for the performer. The lack of exhaustive representations also means that the performer must find different ways to realise the piece. This case study has included a compendium of possible solutions drawn from my research.

Absence of notation works as an aid for the performance of the intricate detail among the dense counterpoint of the piano part. In addition, the closed-ended approach to the tape provides the right amount of elasticity that can be utilised in the performance of this piece.

3.2 Repertoire example: Kevin Ernste - Long Path (2002)

Long Path was written in 2002 for Solungga Fan-Tzu Liu. This piece presents one section of solo electronics and another three-minute section of piano and electronics among other sections of solo piano. In the first instance, the electronic material features a reading of the eponymous poem written by Muren Hsi. The second instance features the same reading with the addition of spectral sounds that blend with the piano material.

長路 **席慕蓉**

像一顆隨風吹送的種子
我想　我或許是迷了路了
這個世界　絕不是
那當初曾經允諾給我的藍圖

但是　已經有我的淚水
灑在山徑上了　已經有
我暗夜裡的夢想在森林中滋長

我的渴望和我的愛　在這裡
像花朵般綻放過又隱沒了

而在水邊清香的陰影裡
還留著我無邪的心

留著我所有的
遲疑惶惑　卻無法更改的
腳印

中文翻譯 ： 麥淑賢

Long Road **Muren Hsi**

Like a seed carried by the wind
I thought, perhaps I am lost
This world is certainly not
The blueprint that was once given to me in a promise

But already, my tears
Have been shed along the trail. Already
My nocturnal dreams have taken root among the trees.

My desires and my love, here
Like flowers they have blossomed,
Like flowers they have faded.

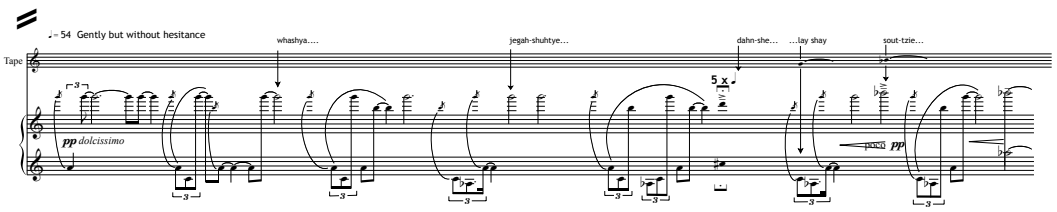
In the fragrant shadows facing the stream
Remained my innocence –

And so remained all my
Hesitant, apprehensive, yet indelible
Footprints

English translation: Su Yin Mak

Ex. 3.2.1: Poem.

This work features a transcription of the poem as notation for the electronic track. These notations are represented phonetically and placed above the piano material.



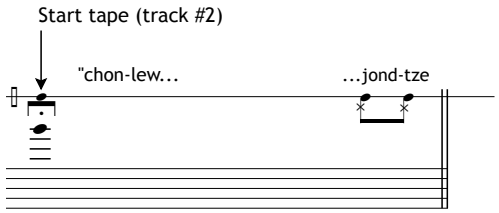
Ex. 3.2.2: Notation of tape.

Long path is structured in five sections. However only two of these feature electronics.

	Section 1	Section 2	Section 3	Section 4	Section 5	Coda
Instrumentation	Tape solo	Piano solo	Piano solo	Piano and tape	Piano solo	Piano solo
Metronome mark	n/a	♩=40-54	♩=60-72	♩=54	♪= ca.108	♩= ca. 54
Length[89]	0:00-1.09	1.09-6.02	6.02-7.50	7.50-10.59	10.59-12.47	12.47-end

Table 3.2.1: Long Path's structure.

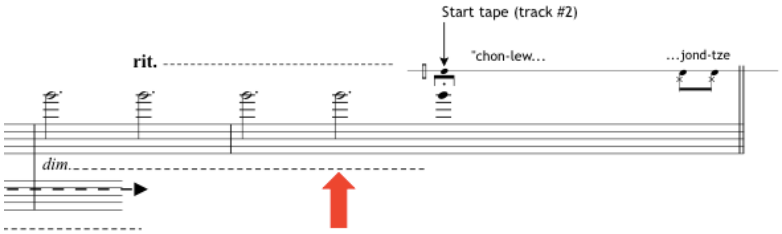
The text works as an overarching device for synchronicity between the piano part and the spectral sounds from the tape, presenting arrows that suggest the placement of each event in relation to the piano part. In addition, some tonal areas are also presented in the tape stave. There is also a rhythmised word that suggests the metronome mark for this passage:



Ex. 3.2.3: Rhythm cue (start of piano and tape section).

There is a patch that can be triggered at the end of the middle section, to begin the tape. This ensures optimal synchronicity and allows the solo piano sections to be performed freely. In my recording of this piece track #2 is triggered before its mark on the score.[90]

[89] These timings correspond with my live recording of the piece. This score features no bar numbers or rehearsal marks.
[90] This choice was agreed by the composer during the dress rehearsal of the piece (24/04/18).



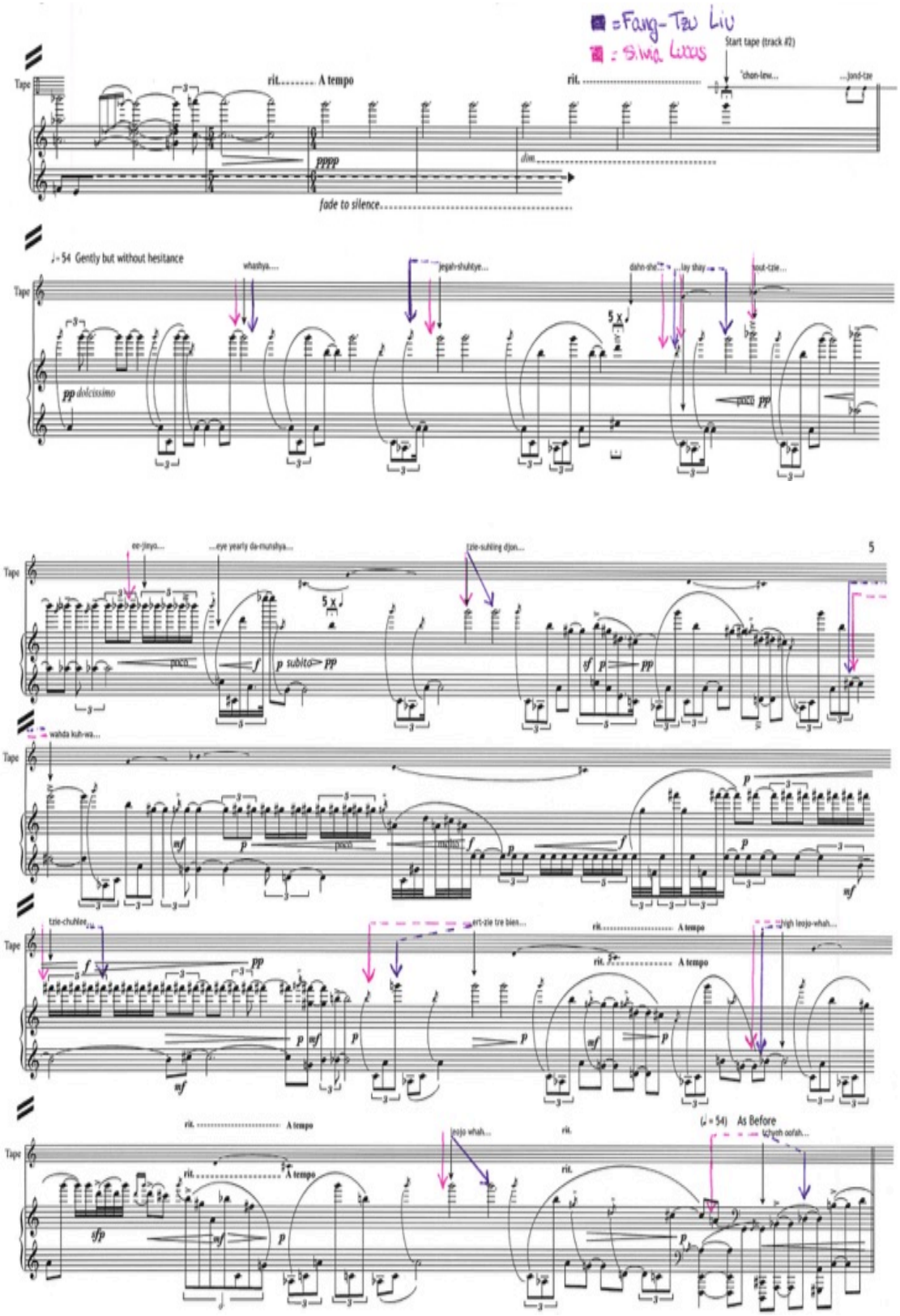
Ex. 3.2.4: Start of tape in my performance.

The approach to tempo in this piece is conceived in an intuitive way, acknowledging the human nature of the performer as well as suggesting rubato and tempo elasticity. It is worth noting that metronome marks during solo sections are not easily relatable and are variable in range.[91] The piano and electronics section provides a definite metronome mark of ♩=54. In this section, there are still ritardando marks within the piano and tape section. Inevitably, these will translate in small misalignments that should re-align naturally to the notated events after a few seconds.

At this point, it was necessary for research to compare past performances of this work. Fan-Tzu Liu's recording is accessible through the composer's YouTube channel.[92] This performance provides a first-hand testimony of the composer's intentions as it is performed by its dedicatee. Liu's performance of the work tackles the arrows in an approximate manner. However, this does not affect synchronicity with the spectral sound regions on the tape. This suggests that she was using an aural approach in order to keep synchronised, although with some disregard to the rigorous notational instructions. I find it is desirable to obtain aural synchronicity as this enhances the colour palette provided by the electronics.

In the next example, I have pointed out how Liu's synchronisation worked compared to mine:

[91] e.g ♩=40-54 - beginning of work; or ♩=60-72 - second system 3rd page.
[92] This recording can be found in the appendix folder.
https://www.youtube.com/watch?v=CQo_b4YxWuo



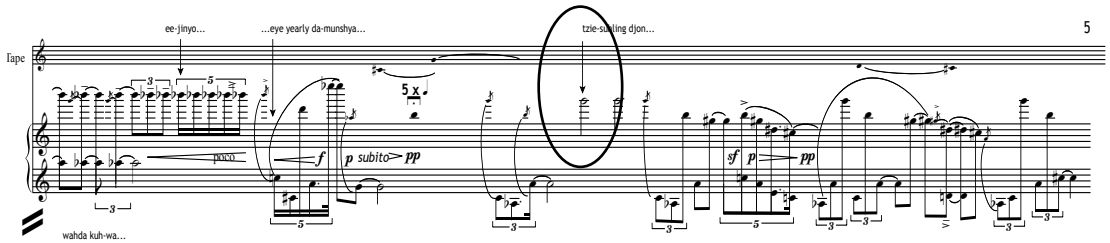
Ex. 3.2.5: Comparison of alignments from Fan-Tzu Liu and my recording.

The arrows in the notation of the tape suggest a specific approach, whereas the ritardando markings suggest an open-ended approach. These ritardandi are also featured in the tape stave. This means that the track will be more spacious during those markings. Acknowledging tempo flexibility will inevitably translate into multi-temporal performances where strict synchronicity is not essential. My main concern at the time was to acknowledge the notations provided, at the same time as conveying a coloured performance that would blend with the spectral sounds of the tape. However, Ernste's advice was to provide as much dynamic variety as possible without paying too much attention to synchronicity. After Ernste's comments I changed my approach and prepared myself to ignore possible misalignments during my performance.

After my performance of *Long Path*, I set a few questions for a retrospective investigation of the notation of this piece.

1. Is the notation realisable to its written extent when following strict metronome marks? Is rhythmic flexibility desirable or necessary?
2. How is the interpretation of the same material going to be affected by the addition of the tape?
3. How much delay is possible in order to still be synchronous?

1. I experimented performing the piano and tape excerpt, having listened to the metronome just before I started playing, then left the metronome flashing the beat next to me. The findings were that the notation suggested by the arrows was not entirely possible when conveying a strict approach to pulse. Performing with a metronome presented a dichotomy in performance. The arrows in the notation of the poem suggest a strict approach, for instance:



Ex. 3.2.6: Arrows in notation.

If this particular event is not performed as suggested by the arrow, the performer will naturally rush the remaining events in order to compensate for the misalignment. Trying to overcome this tendency did not solve the problem of synchronisation immediately. Synchronisation would normally recur after a few missed arrows, even when sticking to the metronome. After many attempts at trying to achieve the notated synchronisation, it became clear to me that any lack of synchronicity was caused mostly by a tendency to blend with the spectral sounds.

There is enough elasticity in the electronics for human *ritardandos.* In addition, these can be performed intuitively when the words before and after the event are in full synchronisation.[93]

2. The initial section should reflect the hesitation suggested in the performance indication. Different approaches to acciaccaturas and pauses helped this indication. With regards to the initial tempo of ♩=40-54, it is worth noting that in my performance there was a tendency towards the latter, mainly due to the memorisation of tempo that I experienced for the tape section. It became more natural to me to remember the speed of the tape section. Having practised both sections, the tape section informed the use of pedal at the start, where I aimed to imitate the spectral sounds with the resonance of the piano. Afterwards, I used less pedal in order to let the tape material be heard.

3. In this piece there is room for at least three beats delay, as changes in the spectral material are very settled. Notation of the words is not rhythmised (apart from the initial cue), which suggests a more open approach to synchronisation. The ending of the tape should merge onto the next solo piano section and there is no indication of where exactly this event is due to happen. Generally, rhythm and pulse in this section can be approached freely without major consequences in synchronisation.

This investigation informed how the approach to notation can be conceived after analysing its performance implications. From a theoretical perspective, the notation

[93] Test recording provided in accompanying case study folder.

suggests a very accurate representation. However, the result of the research and realisation of this work indicate that it can be approached in accordance with works that present little or no graphical representations. This is due to the approach to tempo markings, the relations in the use of material throughout its structure and the open-ended approach of the tape which translates into no necessity for strict synchronisation. Instead, it is desirable to have an aural approach as the spectral sounds of tape material in addition to the word cues work as flexible indications for coordination. The combination of these elements functions as a flexible enabler for synchronisation. These principles are in accordance with the performative response of works of imprecise notation where the pianist does not need rigorous synchronisation.

3.3 Case study 5: Piyawat Louilarpprasert - *Rumbling* (2018)

This case study features a work for live electronics, commissioned for the concert at Cornell University on the 24th of April 2018. The aim of this case study is to investigate the results of notation of live electronics in performance as a possible ramification of my research into this field. *Rumbling* presents some notations for the electronics, however these lack graphical detailed representations. Sounds are described by words and sound density is described by the use of simple graphics. These representations are in accordance with the principles of imprecise notation.

Performing with live electronics requires a different approach: timings are elastic and the level of interaction with electronics can be reciprocal. In the instance of *Rumbling*, there was a very active connection between Louilarpprasert and myself, as the material featured some flexibility. The active interaction defined this as an ensemble piece, where we cued each other in order to record passages and play the processed sounds back in real time.

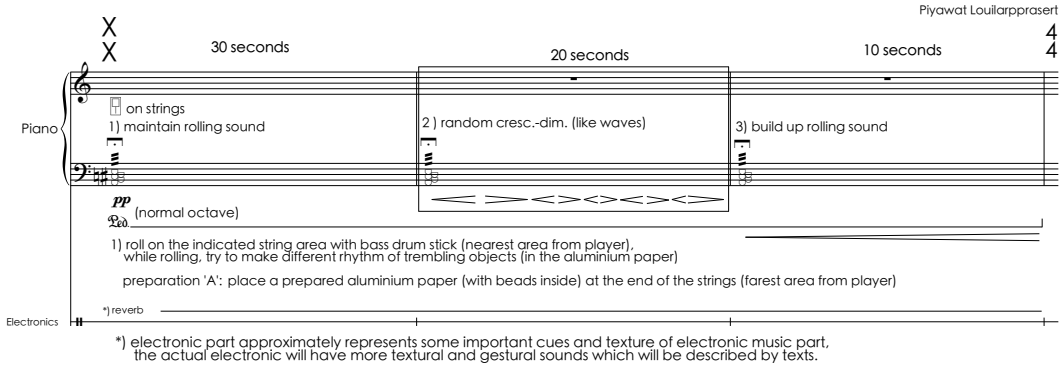
I received this work without having had prior conversations with Louilarpprasert. His only instructions were to compose a piece for piano and electronics and no specification as to pre-recorded or live was given.

This work was premiered from a final draft score that did not feature instructions on how to operate the live electronics (which were controlled by Louilarpprasert for the premiere).[94] The piano part featured only very small changes in note durations in the new edition.

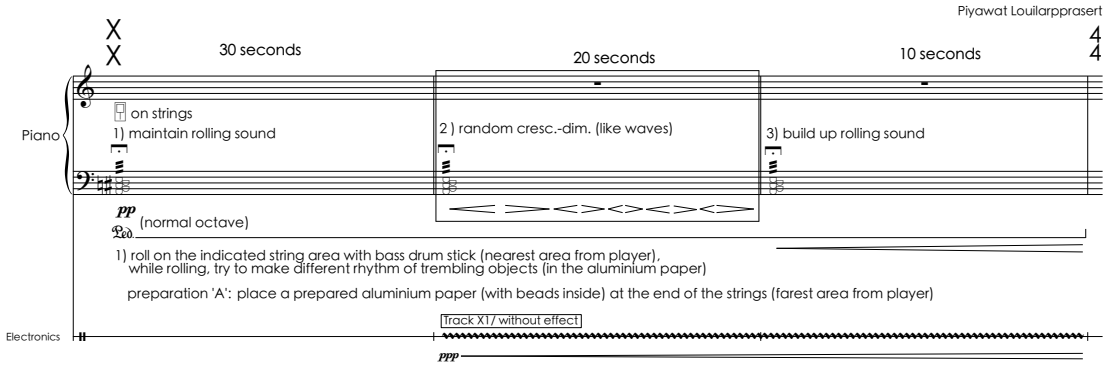
The majority of the performance points described in this chapter have been made from the draft edition. However, there will be other points that have been realised after comparing both editions and reflecting on the performance and rehearsal process.

[94] Included in the accompanying case study folder.

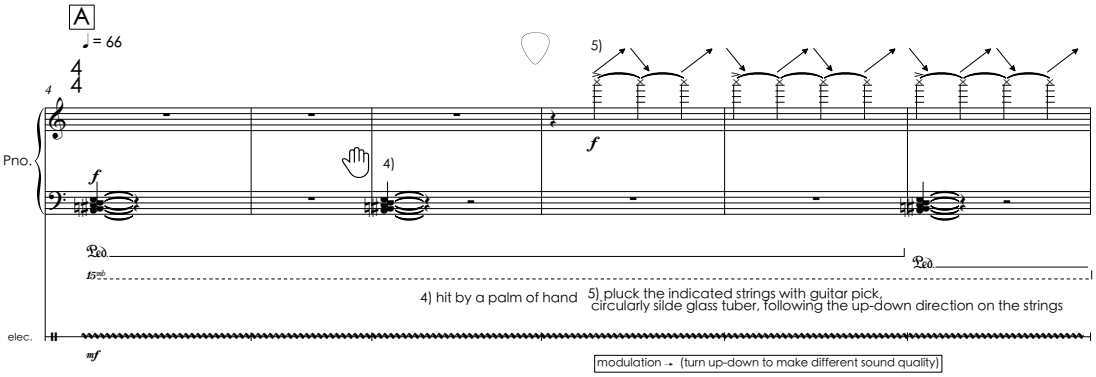
In the final edition the notation of the live electronic part features written descriptions of the events alongside graphical markings that represent the density of the layers of distorted electronics as well as precise dynamic detail.



Ex.3.3.1: No dynamic markings in electronics part from b.1-3 (V_1).[95]



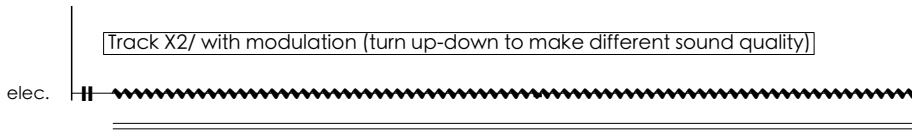
Ex. 3.3.2: Dynamic markings in electronics part (b. 1-3) (V_2).[96]



Ex. 3.3.3: Notation of electronics and piano (b.4-9)(V_2).

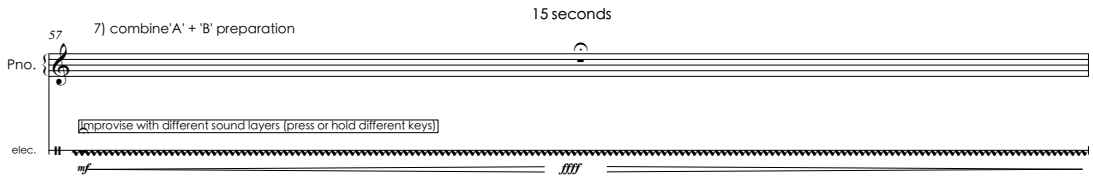
[95] Draft Version: V_1
[96] Final Edition: V_2

There are also instructions for the realisation of the live electronic track:



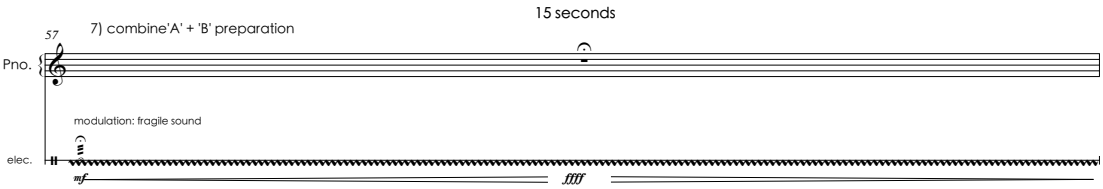
Ex. 3.3.4: Instructions for live electronics. (b.43) (V_2).

These instructions also include controlled improvisation for the live electronics:



Ex. 3.3.5: Improvisation on electronics (b.57) (V_2).

Improvisation in live electronics helps change the preparation set-up inside the piano. This was difficult to discern from the first edition, as there was no indication of the open-ended approach to the electronics.



Ex. 3.3.6: b.57 in V_1.

When rehearsing from the draft version, this point became evident. The flexibility of these interludes provides enough time to adapt to the dimensions of the performance venue, the placement of the preparations and the size of the piano. The change in preparation should not be rushed as it can provide undesired noise to the audience. Exhaustive notation of electronic sounds would not provide additional help in these sections as it is unlikely to be followed.

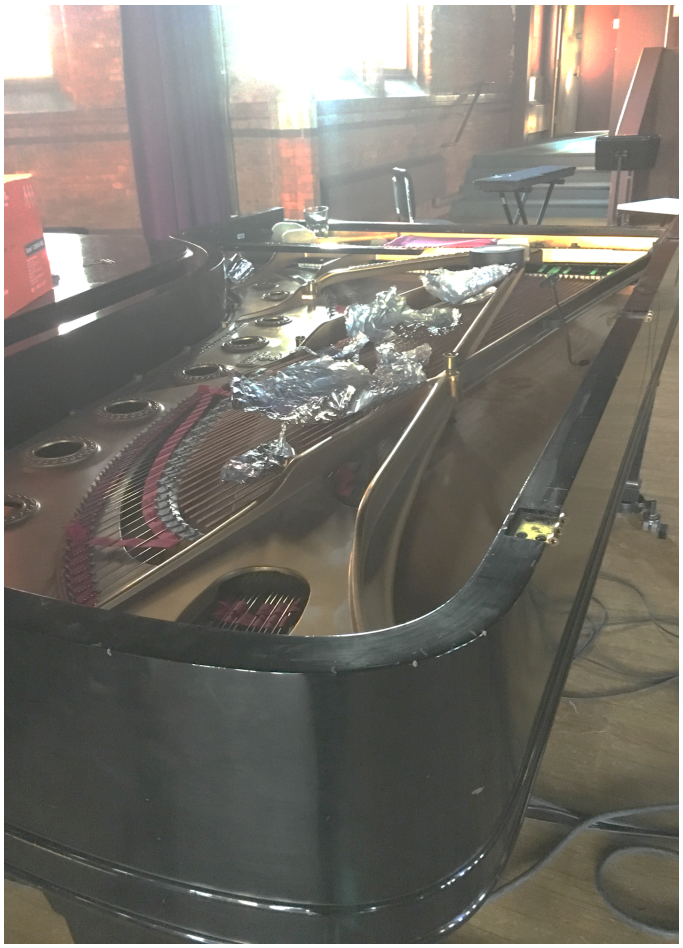


Fig. 3.3.1: Preparation A in Barnes Hall (Paperclips inside foils, bass drum mallets and glass).[97]

Interaction with electronics took place a few days before the premiere of this work, when Louilarpprasert and I rehearsed daily.

The level of detail of the electronic representations became irrelevant once we started playing together. Representations provided in my score were sufficient.[98] I needed to be aware of when the electronics would enter. We both felt that there was a need for extra annotations in our scores; however, most of these were to do with visual interactions (cues) between us. I added cues at the following bars:

- B.20: preparation of interlude (end of A);
- B.22: confirmation from Louilarpprasert (B);
- B.48: for Louilarpprasert's records (C);

[97] Model: Pokal 35cl from Ikea. Used to perform "glass tuber" instructions during section A. In b.7 and b.20 I rotated the glass on the upper register's strings.
[98] Draft Version.

- B.55 : preparation of interlude (D);
- B. 58: confirmation to continue (E);
- B. 80: check-up point (G);
- B. 118: check-up point (G).

At these particular points I would add extra time or cut timings short, depending on Louilarpprasert's cues and responses. Similarly, I was free to add extra repetitions of the patterns if there was no visual contact at the specified times. This is the case of the recorded rehearsal, where there are examples of extra pauses in b.55, omission of chords in b.56 and ad libitum repetition of figure 7 in b.82.[99] These variations demonstrate multiple performance solutions in this piece, as allowed by its flexibility. The material of the live electronics also contrasted with the live recording of the premiere of this piece partly because of the improvisational approach to some of the sections.

The other difference between the two recordings has to do with the timings.[100] The rehearsal version was recorded with a smaller piano in a smaller venue which meant those transitions were realised more quickly.

As mentioned before, these annotations were agreed by Louilarpprasert and I. They are not included in the final score as they will vary, depending on the equipment used. If the piece is to be performed again with the same equipment, it is possible to add these cues for reference but these will still need testing during rehearsal.

It was concluded that there was no necessity for accurate graphical representations of the sounds due to the active involvement of both parts. The use of notation works best in this instance as an additional instructional line for the person in charge of the electronics. Furthermore, the graphic representations of density of material and dynamics are sufficient for performance.

This chapter serves as an ad-hoc case study on how the notation worked in this particular piece. Conclusions can be transferred to works that feature the same level

[99] Case study folder.
[100] Rehearsal was 9'24'' and premiere was 10'57''.

of involvement and improvisation. However, there is still room for research into the notation of live-electronics as this approach is not representative of all the possibilities that can arise from this performance discipline. The issue of timing and synchronisation had to be considered from an interactive perspective, which made the performative response similar to imprecise notation. In this case, the style of notation reflected flexibility as synchronisation was achieved by the implementation of live electronics.

Conclusion

I demonstrate through the case studies above that the style of notation of the fixed media has a significant impact for the performer.[101] Different approaches highlight certain performance issues and allow for a stronger interaction with the work. I have chosen to categorise different approaches as a means of documenting how these issues and benefits can be applied in performance. Each case study of this document has shed light on how my performative response has been influenced by the style and accuracy of the provided notation for the fixed media.

In the case of *Resound* the mixture of style of notation (traditional and graphic), does not affect the performative response. The provided notation provides high detail in pitch, dynamics and articulation. The notation of the tape is so precise that synchronisation challenges only occur in short piano solo interludes where the tape stave is silent. Arguably, these interludes could present an opportunity to stop the track and trigger the next sample, once the interlude is performed. However, I do not consider that having triggered samples would have been beneficial. The fact that the tape is self-contained acts as an enabler for the rigorous response needed as dictated by its notation. Adding flexibility to this would have been detrimental. Other synchronisation problems occur when the spectral sounds don't present a strong beat. For this reason, the pianist, enabled by the close ended approach of the tape, must keep a steady beat throughout the work.

Google Gets A Dog's notations are simple, yet effective and provide enough constraint for the performer to be in synchrony. The only exception is b.123 (ex.1.2.2), where a rhymical representation of the words would have reassured an enhanced level of synchronisation. It would be impractical to consider this work as hybrid for just this instance. The case of theatricality provided an extra layer of complexity in the realisation of this work. The choice of adding these elements was in direct relation to the material of the fixed media, as the instructions would seem more credible to an audience if I reacted naively to them whilst playing. Theatricality was enabled

[101] With an additional chapter on live electronics

by the successful representations from the altered speech from Google. Otherwise, this challenge could not have been addressed from a performative perspective. The issue of performing with click-track was addressed, albeit not successfully in performance.[102] For that reason, theatricality was better conveyed in its premiere, where the lack of click-track allowed me to show a smaller amount of musical mannerisms at the expense of lack of synchronicity at certain points. Nevertheless, the performative response in this work was akin to that of pieces which feature high detail in notation and provoke a strict reaction to pulse and rhythm.

In the case of *Dos Máquinas*, the addition of fixed time cues and the quantitative representation of breathing sounds are sufficient information for coordination. These two parameters evolved into the necessity of performing with a stopwatch and in a clear score for performance. The fact that *Dos Máquinas* does not present excessive representations does not make this work a hybrid. Similarly, performing with stopwatch helps the realisation of the musical detail as the gestures are distinct and approachable. In this instance, the notational precision was obtained by an economical approach to notation which was proportional to the material of the work. The notational elements here ensured that the rigorous performative response was achieved in a different scenario where pitch, pulse and rhythm were not approached conventionally, as in the other cases of precise notation.

Key Jack provided a new vision on precise notation, and how it can be achieved through aural scoring. This case study served as a summary of how most of the strategies (apart from stopwatch relations, which do not apply in *Key Jack*) discussed in precise notation can be achieved and performed aurally. This case also showed more emphasis on theatricality and practice strategies on this matter, complementing the case-study of *Google Gets a Dog*.

Tombeau de Messiaen is a representative example of hybrid notation. This work features both elasticity and strict synchronisation. The level of precision in the notation is proportional to the level of coordination required. I agree with the omission of time cues in the score as stopwatch synchronisation is not an option for

[102] Due to technical failure.

this piece. Performing this piece with a stopwatch would not provide a successful outcome as the performative focus would vary dramatically. The timings that I have provided are a reflection of my learning process and have helped my aural knowledge and practice of this piece. These should be useful for practice purposes. Acknowledging the flexibility embedded by the composer suggests that coordination comes from a combination of aural relations and a strict approach to pulse. These performative responses occur in hybrid notation.

The examination of *inter-* pointed out that the first version of the work would be within the boundaries of absence of notation and hybrid, as the fixed media notation featured scarce information. The issue of categorising the second version proved a challenge for this research as the notation of the fixed media featured great detail in a similar style to the piano part. In this instance, the nature of the sounds of the fixed media suggested a certain degree of flexibility in its coordination, as suggested by its performance notes. On the other hand, the imperative use of a stopwatch invited a strict approach. This dichotomy should be considered, rather, as overlapping categories. The performance response becomes hybrid as the focus shifts away from relying on written cues and stopwatch synchronisation.

The case study of *Hitchcock etudes* is an example of some of the challenges of notating and synchronising works that present such different sections and varied approaches. In this case, it can be seen that compromises were made and rectified by the composer in the use of click-track, through revision of different versions. In this case, the score would have benefited from extra markings indicating the start/end points of click-track and similarly, the dynamic balance between tape and piano could have benefited from a more exhaustive mastering in the provided tape.

Finding a suitable category for *...sofferte onde serene...* did not present a challenge, as there are no representations of the tape material. However, the exercise of analysing the implications of not using notation was crucial for the development of this project. The absence of notation works as an enabler of aural coordination. In these cases, the performer must find solutions for its practical realisation that arise from an exhaustive analysis of the work. This case study features detail on my analytical practice, provided through a series of recordings that change performative

parameters such as balance and use of stopwatch. These represent how the understanding and synchronisation have evolved as my aural understanding has improved. In my opinion, the absence of notation in *sofferte* is not unintended. I believe that the performance of this work is enhanced by the open-ended approach that the lack of notation provides. In this way the performer is capable of *...suffering serene waves...* as proposed by its title.

Similarly, the issue of categorising *Long Path* was carefully considered because of its performative response. Aural coordination provided stronger synchronicity as proven through my experimentation with a metronome. Therefore, the categorisation of *Long Path* proved to be most similar to the responses of absence of notation. The spectral sounds served the right level of constraint for performance.

The addition of *Rumbling* in this research was intended to compare how performing with live electronics changed responses when considering its notational aspect. This case study was conceived as seminal for further research in order to implement this methodology to live electronics. It was concluded that in this case, the performative response was similar to imprecise notation because of the flexible element. However the conclusions can only be applied to works that feature a similar performative response. In this case, highly detailed representations would not have provided a greater degree of synchronisation. We achieved optimal synchronisation through visual cues from each other rather than from notation.

The addition of *Swan* (2016) by Murat Çolak to my portfolio of recordings serves as an exercise to confirm that, in the case of chamber music, depictions of the contents of fixed media are dependent of the kind of ensemble and available technology. In this case, the 8 player ensemble is directed. The pianist, conductor and percussionist have access to a click-track. Using a click-track alongside a conductor ensures synchronicity, making further notations redundant. The addition of a bass synthesiser to the piano part can challenge the performance of this piece. In my experience, I overcame this by positioning the bass-synth near my left-hand side (rather than on top of the piano, as advised by the composer) in order to be able to pay closer attention to the conductor and the rest of the ensemble. It was also important in to rehearse the choreography of swapping between piano and synth

with the click-track and produce the same set-up for my personal practice. Once these issues were tackled in my personal practice, my approach to performing with fixed-media proved to be the same in a chamber context as it would be in a solo performance. The main reason for this is that the addition of fixed-media constrains timing in the same manner in both solo and chamber contexts. The notation in the piano part did not include any depictions of the fixed media content, however there were scarce graphic notations and time cues in the full score for the conductor.

Methodologically, the categories function as guidelines for each approach, not limiting a specific work to a specific category for its entirety. At this point, each category has the potential to be successful when its properties are considered. In order to determine each category, I assessed how the notations interfered with my performance practice, bearing in mind the contents of the tape alongside its performative response.

Having conducted this research my main findings on each category of notation are:

- Precise notation: provides a rigorous response from the player which tends to approach pulse as meticulously as possible. The visual reassurance of the notation acts as an enabler for accuracy and rhythmic verticality. It creates the illusion of performing with a "ghost" player as the notation informs expectations in a similar way to chamber music. In terms of practice, this category facilitates the learning process in the sense that the performer has all the information available in the score. A pianist would naturally feel like playing a chamber music work where the instrumental part can be followed and understood as the pianist plays. All the works that are featured in this category in my research have proven to be the most demanding for rhythmic accuracy.

- Hybrid notation: promotes a certain degree of flexible synchronisation, working successfully when representing spectral sounds with various degrees of rhythmic clarity. It is also useful for open-ended approaches to the piano part (i.e controlled improvisation). This category usually requires further annotations from the player. These might include: time cues, graphic descriptions or written descriptions of the sounds. Hybrid works usually take longer time to process, as the

notations usually need to be expanded by the performer. Composers wishing to include hybrid notations should be aware of the complexity of this task for performers as learning times are usually higher in this category of works. Hybrid notation enhances familiarity from an aural perspective and works as a practice aid for the player. Works that fall into this category might feature passages of strict synchronisation which ought to be notated in a precise fashion for its successful realisation.

- Imprecise notation: an absence of exhaustive notation typically means that there will be a greater aural approach in performance. In this instance, the player will need to study the track more thoroughly. This category presents the most flexible approach possible within the limits of required synchronicity. Performing with this kind of notation can be compared to performing as an accompanied soloist. Tempo should always be acknowledged and there are multi-temporal solutions to its performance. Imprecise notation tends to be more common in live-electronics because of its elastic properties. Nevertheless, it can be used with fixed media once its parameters are fully considered from both the performance and compositional perspectives.

I have contributed to the repertoire for piano and fixed media through collaboration with composers and subsequent commissioning. I chose a wide variety of composers, in terms of their approach, to elicit different responses to the notation of the fixed media. This deliberate decision allowed for a wide set of approaches to develop my research. These collaborations have expanded the performance approach to fields of extended techniques, rehearsed (timed) choreography and theatricality.

There have been different degrees of collaborative involvement for each case study. For example, I collaborated closely with Sergio Cote for the case study of *Dos Máquinas*. Through our conversations, my research influenced Cote's approaches to notation. I revised the first draft of the piece and suggested what notations would provide the most relevant information with the greatest effect. In this case, the material of the electronics would not suggest an aural approach for

synchronisation. Consequently, the fixed media notation needed to provide time cues alongside a shorthand representation of the sonic material.

In the case of *Google Gets A Dog*, my collaboration with Uren took place during rehearsal, where we decided the optimal degree of theatricality for the realisation of the work. My research did not influence the approach to notation. However, Uren's requests during rehearsal informed my research in performance.

Collaboration with Smith for *inter-* took place during rehearsal and revision processes. It became very clear to us that this work could be enhanced through a more refined approach to the notation of the electronic sounds. This action provided an opportunity for appraisal from two different approaches to notation and how these affected performance.

The case of collaboration in *Rumbling* was very closely developed by Louilarpprasert and myself, as we both performed in this work. The performative involvement from the composer in rehearsal provided me with a first-hand testimony of how the material worked alongside the live electronics. Consequently, this action informed my research into notation as seen in the case study.

This research project has focused on fixed media. However, further possible ramifications of this study can be addressed following the same principles. It would be useful to apply this methodology to further research on the performance of live-electronics, as the importance of the notation of the electronics has been commonly considered more secondary between composers and performers. As previously seen in *Rumbling*, imprecise notations facilitated a clear interface for the realisation of the live-electronics. Other examples of this can be found in *Staring into the middle distance* (2016) by John Uren which was premiered by the composer and myself.[103] In this case, electronics were clearly following the pianist and worked as a complement to my performance. This meant that there was little or no need to notate these examples precisely. These two isolated cases are not representative of the extensive body of repertoire for piano and live-electronics. In the same manner,

[103] Score can be found in appendix folder.

there is room for further research on other areas of accompanying media such as moving image, interactive control devices and artificial intelligence.

This research has been addressed towards performers and composers alike, with the main focus of contributing to multimedia performance practice. As composers continue examining and expanding fixed-media elements in their work, performers must constantly adapt to new challenges brought up by such explorations. My research intends to contribute some notational insight which is mutually beneficial to both parties. The main outcome of this document is to preserve and promote fixed media performance through analysis of notation and my own performance practice.

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Scores:

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John Uren. *Google Gets A Dog.* Self- published by composer. 2017

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Nicole Lizée – *Hitchcock Études (v.16min)*. Quebec. Canadian music centre. 2010

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Recordings:

Maurizio Pollini (1979). ...Sofferte onde serene... . [track 8] On Maurizio Pollini – Nono / Manzoni – Como una ola de fuerza y luz; ...Sofferte Onde Serene...; Masse. Deustche Gramophon. Europe

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Appendix 1: List of performances and recordings

This list is representative of the order of the repertoire examples and case studies as illustrated by the document. Sound files can be found in the accompanying memory stick in the "Recordings and Scores" folder.

1.1 Case study of David Horne - *Resound*
Video recording: (08:01)
15/11/17 North West New Music Solo recital. Carole Nash Recital Room.
Royal Northern College of Music
Manchester. UK

1.2 Case study of John Uren - *Google gets a dog*

Video recording 1: (07:27)
15/11/17 North West New Music Solo recital. Carole Nash Recital Room.
Royal Northern College of Music
Manchester. UK

Video recording 2: (07:47)
5/9/18 Doctors in Performance Conference. Lecture-Recital
Lithuanian Academy of Music and Theatre
Vilnius. Lithuania

1.3 Case study of Sergio Cote - *Dos Máquinas*

Recording 1: (12:05)
24/4/18 Solo Recital. Barnes Hall
Cornell University. New York. USA

Recording 2: (08:33) test recording
7/08/17 Documentation for realisation of 1st draft. Home recording. Madrid.
Spain.

1.4 Repertoire example of Michael Beil – Key Jack

Recording 1: (12:32)
7/07/19 Video Recording at RNCM

2.1 Repertoire example of Jonathan Harvey - *Tombeau de Messiaen*

Recording 1: (08:35)
19/1/17 Studio recording at RNCM

2.2 Case study of Aled Smith - *inter-*

Recording 1: (21:26)

24/4/18 Solo Recital. Barnes Hall
Cornell University. New York. USA

Recording 2: (17:56)
23/10/18 Studio Recording at RNCM

2.3 Repertoire example of Nicole Lizée – Hitchcock Études

Recording 1: (20:49)
25/10/19 Studio recording at RNCM

3.1 Repertoire example Luigi Nono - *...Sofferte onde serene...*

Recording 1: (14:00)
24/4/18 Solo Recital. Barnes Hall
Cornell University. New York. USA

Recording 2: (14:04)
5/9/18 Doctors in Performance Conference. Lecture-Recital
Lithuanian Academy for Theatre and Music
Vilnius. Lithuania

Recording 3: (13:51)
30/10/18 Studio recording at RNCM.

3.2 Repertoire example of Kevin Ernste - *Long Path*

Recording 1: (14:07)
24/4/18 Solo Recital. Barnes Hall
Cornell University. New York. USA

Recording 2: (10:27)
11/11/18 Experiment of electronics, piano and flashing metronome. This recording consists of 3 takes of piano and tape material.
Studio Recording. RNCM

3.3. Case study of Piyawat Louilarpprasert - *Rumbling*

Recording 1: (9:18)
23/4/18 Rehearsal
Cornell University. New York. USA

Recording 2: (10:57)
24/4/18 Solo Recital. Barnes Hall
Cornell University. New York. USA

3.4 Chamber music example: Murat Çolak – Swan
Live Recording: (30:55)
8/6/19 VIRTUALLYREALITY concert.

Hallé St. Michaels. Manchester. UK

Total timing: 4h 11min

Appendix folder:

Luigi Nono *...sofferte onde serene...* (Learning process documentation)
John Uren. *Staring Into The Middle Distance* (2016) (score)
Fan-Tzu Liu's Recording of Kevin Ernste's *Long Path* (2002)
Nicole Lizée – *Hitchcock études v.16*
Recording 2: (16:43) 12/10/19 Studio recording at RNCM

Appendix 2 Further repertoire chart

Type of Notation of electronic track.	Precise	Hybrid	Imprecise/No notation
	D. Horne – *Resound* (1995)	J. Harvey – *Tombeau de Messiaen* (1994)	L. Nono – *...Sofferte onde serene...* (1975-77)
	D. Horne – *Sostenuto* (1996)	A. Smith – *I n t e r* (2018)	K. Ernste – *Long path* (2002)
	J. Uren – *Google Gets A Dog* (2017)	N. Lizee – *Hitchcock Etudes* (2010-15)	P. Louilarpprasert – *Rumbling* (2018)
	S. Cote – *Dos Máquinas* (2018)	N. Lizee – *Kubrick Etudes* (2013)	S. Montague – *Haiku* (1987)
	M. Beil – *Key Jack* (2016)	M. van der Aa – *Transit* (2009)	J. Uren – *Straring into the middle distance* (2015)
	F. B. Mâche – *Nocturne* (1981)	M. van der Aa – *Just Before* (2000)	M. Hindson – *AK47*
	G. F. Haas – *Ein Schattenspiel* (2004)	M. Hindson – *Plastic Jubilation* (2000)	H. Vaggione – *Till* (1991)
	M. Babbitt – *Reflections* (1974)	M. Stroppa – *Dialoghi*	J. L. Adams – *Dark waves*
	Nadja Plein - *Dew*	M. Stroppa - *Contrasti*	P. Nunn – *Music of the Spheres* (2008)
	M. Davidovsky – *Synchronisms no. 6* (1970)	K. Stockhausen - *Kontakte*	K. Malone – *Count me in* (2005)
	A. Clementi – *Madrigale* (1979)	P. Manoury – *Pluton* (1988)	
		C. Dodge – *Any Resemblance is Purely Coincidental* (1980)	